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In reply, please refer to:
File:

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NPDES PERMIT NO. HI 0020117

FACT SHEET: **RENEWAL OF THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT AND ZONE OF MIXING (ZOM) TO DISCHARGE TO MAMALA BAY, PACIFIC OCEAN, WATERS OF THE UNITED STATES**

PERMITTEE: **CITY AND COUNTY OF HONOLULU**

FACILITY: **SAND ISLAND WASTEWATER TREATMENT PLANT**

FACILITY MAILING ADDRESS
City and County of Honolulu
Sand Island Wastewater Treatment Plant
1000 Uluohia Street, Suite 308
Kapolei, Hawaii 96707

FACILITY STREET ADDRESS
City and County of Honolulu
Sand Island Wastewater Treatment Plant
1350 Sand Island Parkway
Honolulu, Hawaii 96819

PERMITTEE MAILING ADDRESS
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This Fact Sheet includes the legal requirements and technical rationale that serve as the basis for the requirements of the draft permit.

A. Permit Information

The following table summarizes administrative information related to the Sand Island Wastewater Treatment Plant (hereinafter, facility).

Table F-1. Facility Information

Permittee	City and County of Honolulu
Name of Facility	Sand Island Wastewater Treatment Plant
Facility Address	1350 Sand Island Parkway Honolulu, HI 96719
Facility Contact, Title, and Phone	Mr. David Heard, Regional Superintendent, (808) 768-4438
Authorized Person to Sign and Submit Reports	Mr. Wesley T. Yokoyama, P.E., Director (808) 768-3486
Mailing Address	1000 Uluohia St, Suite 308 Kapolei, HI 96707
Billing Address	Same as above
Type of Facility	Wastewater Treatment Plant
Industrial Storm Water	No, covered under NPDES Permit No. HI S000002.
Pretreatment Program	Yes
Reclamation Requirements	No
Facility Design Flow	90 million gallons per day (MGD)
Receiving Waters	Mamala Bay, Pacific Ocean
Receiving Water Type	Marine
Receiving Water Classification	Class A Wet Open Coastal Waters (HAR Section 11-54-06(b)(2)(B))

1. NPDES Permit No. HI 0020117 for the Sand Island Wastewater Treatment Plant ("SIWWTP" or "facility"), including ZOM, became effective on November 2, 1998, and expired on November 3, 2003 ("1998 Permit"). The Permittee submitted an application for continued 301(h) variance on May 5, 2003. The Permittee reapplied for an NPDES permit and ZOM on December 21, 2010, with additional information submitted on May 16, 2011, September 16, 2011, March 14, 2012, March 23, 2012, April 3, 2012, and June 19, 2013. The NPDES Permit and ZOM were reissued on November 12, 2014, with an effective date of January 1, 2015, and an expiration date of November 11, 2019. During the permit term, the permit underwent two modifications on December 23, 2014 and September 10, 2015 (collectively, "2014 Permit"). The 2014 Permit underwent a third modification on September 1, 2018, which is further described in Item 3 below. On May 15, 2019, the Permittee submitted a renewal NPDES and ZOM application and $1,000 filing fee for NPDES Permit No. HI0020117. DOH administratively extended the 2014 Permit on November 10, 2019.

2. On December 12, 2014, the Permittee filed a request for a contested case hearing (Docket No. 15-CWB-EMD-3) objecting to several conditions of the 2014 Permit. On April 16, 2015, the Department of Health (DOH), Clean Water Branch (CWB) entered into a stipulated order with the Permittee to stay a number of the contested permit conditions until a final decision was made in the contested case hearing.

3. On May 19, 2017, the DOH and the Permittee reached an agreement on certain contested items and entered into a Third Stipulation, which was approved by the Hearings Officer ("Stipulated Order"). On June 30, 2017, the Permittee provided a new dilution study (dated June 29, 2017). On May 1, 2018, the 2014 Permit was reopened and modifications proposed consistent with the Stipulated Order went into effect with the permit modification on September 1, 2018 ("2018 Permit"). This fact sheet and draft permit continues to incorporate those revisions.

4. The major modifications to the 2014 Permit were authorized under Hawaii Administrative Rules ("HAR") Section 11-55-16; and 40 CFR Section 122.62(a)(2) and 40 CFR Section 122.62(a)(15). In accordance with 40 CFR Section 124.5(c)(2), only the modification of certain conditions was reopened as follows:

a) Removed the DDT maximum daily and average annual effluent limitations and revised the monitoring frequency from monthly to semi-annually pursuant to 40 CFR Section 122.62(a)(15) (specifically, excluding non-detects from RPA calculations);

b) Removed the chlordane maximum daily and average annual effluent limitations pursuant to 40 CFR Sections 122.62(a)(2) (specifically, consideration of additional data and new dilution study) and (a)(15) (specifically, (1) utilizing an RPA that projected daily maximum concentrations, thereby not considering the long exposure time associated with human health criteria for carcinogens (e.g. 70 years) and the fact that human health criteria for carcinogens is expressed as an annual average and (2) the treatment of non-detects in RPA calculations);

c) Revised the dieldrin maximum daily and average annual effluent limitations pursuant to 40 CFR Sections 122.62(a)(2) (specifically, consideration of additional data and new dilution study) and (a)(15) (specifically, (1) utilizing an RPA that projected daily maximum concentrations, thereby not considering the long exposure time associated with human health criteria for carcinogens (e.g. 70 years) and the fact that human health criteria for carcinogens is expressed as an annual average and (2) the treatment of non-detects in RPA calculations);

d) Removed the ammonia nitrogen maximum daily effluent limitations pursuant to 40 CFR Sections 122.62(a)(2) (specifically, utilization of additional data) and (a)(15) (specifically, the treatment of non-detects in RPA calculations);

e) Revised the enterococcus maximum daily and average monthly effluent limitations pursuant to 40 CFR Section 122.62(a)(2) (specifically, consideration of additional data and new dilution study);

f) Revised certain Whole Effluent Toxicity (“WET”) requirements, including for the Instream Waste Concentration (“IWC”) and test species pursuant to 40 CFR Section 122.62(a)(2) (specifically, consideration of additional information regarding projected changes to the treatment train and species sensitivities, and new dilution study); and

g) Removed Part I.5, “Planned Changes” pursuant to 40 CFR Section 122.62(a)(15) (specifically, to achieve consistency with 40 CFR 122.41(l)).

5. The Director of Health (Director) has included in the draft permit those terms and conditions which are necessary to carry out the provisions of the Federal Water Pollution Control Act (P.L. 92-500), Federal Clean Water Act (CWA) (P.L. 95-217) and Chapter 342D, Hawaii Revised Statutes.

6. The Director has reviewed this permit and ZOM application and proposes to issue an NPDES Permit to the Permittee valid for a permit term of five (5) years from the effective date of the permit.

B. Facility Setting

1. Facility Operation and Location

The Permittee owns and operates the facility, located in Honolulu, Hawaii, on the island of Oahu. The facility has an average design flow of 90 MGD and provides primary treatment of wastewater for approximately 460,000 people in the Sand Island Basin. Influent wastewater enters the facility and is distributed to a minimum of two (2) of six (6) available aerated screening channels, where screening and flow measurement using Parshall flumes occur. From there, wastewater is directed to the clarifiers’ influent channels for primary treatment. The clarifiers’ influent channels distribute wastewater to eight 150-foot diameter primary clarifiers. At normal flow, three clarifiers are in use. Primary treated wastewater is then piped to effluent screens and then to disinfection. The facility contains five (5) available dual bank medium pressure ultraviolet (UV) disinfection channels. After disinfection, treated effluent is discharged to Mamala Bay, Pacific Ocean, through Outfall Serial No. 001, at Latitude 21°17’01”N and Longitude 157°54’24”W.

Outfall Serial No. 001 is an 84-inch diameter deep ocean outfall that discharges treated effluent through a diffuser that starts approximately 9,100 feet offshore and 230 feet below the surface of the water. The diffuser is approximately 3,400 feet long with 282 side ports that range in size from three (3) inches to 3.53 inches in diameter and two 7-inch diameter ports in the end gate.

Sludge processing at the facility consists of gravity thickeners, wet sludge storage tanks, and two digesters. Biosolids are processed onsite by an independent contractor.

Storm water from the facility is regulated under the City and County of Honolulu's municipal separate storm sewer (MS4) permit, NPDES Permit No. HI S000002.

Figure 1 of the draft permit provides a map showing the location of the facility. Figure 2 of the draft permit provides a map of the Zone of Mixing (ZOM) and receiving water monitoring station locations.

2. Receiving Water Classification

The Mamala Bay, Pacific Ocean, is designated as "Class A Wet Open Coastal Waters" under HAR Section 11-54-06(b)(2)(B). Protected beneficial uses of Class A waters include recreation, aesthetic enjoyment, and the protection and propagation of fish, shellfish, and wildlife.

3. Ocean Discharge Criteria

The Director has considered the Ocean Discharge Criteria, established pursuant to Section 403(c) of the CWA for the discharge of pollutants into the territorial sea, the waters of the contiguous zone, or the oceans. The United States Environmental Protection Agency (EPA) has promulgated regulations for Ocean Discharge Criteria in 40 Code of Federal Regulations (CFR) Part 125, Subpart M. The Director has determined that the discharge will not cause unreasonable degradation to the marine environment.   Based on the current information, the Director proposes to issue the draft permit.

4. Impaired Water Bodies on CWA 303(d) List

CWA Section 303(d) requires states to identify specific water bodies where water quality standards are not expected to be met after implementation of technology-based effluent limitations on point sources.

On August 16, 2018, the EPA approved Hawaii's 2018 Clean Water Act 303(d) List of Impaired Water Bodies.

The Mamala Bay (Sand Island Offshore) is not listed as an impaired water body for any pollutants in the 2018 303(d) list. Currently, this section of Mamala Bay is reported as a Category 2 waterbody. At present, no TMDLs have been established for this waterbody.

5. Summary of 2018 Permit Effluent Limitations

a. 2018 Permit Effluent Limitations and Monitoring Data

Effluent limitations contained in the 2018 Permit for discharges from Outfall Serial No. 001 and representative monitoring data from January 2015 through February 2019, are presented in the following tables.

Table F-2. Historic Effluent Limitations and Monitoring Data – Outfall Serial No. 001

Parameter	Units	Effluent Limitations			Reported Data[1]		
		Average Monthly	Average Weekly	Maximum Daily	Average Monthly	Average Weekly	Maximum Daily
Flow	MGD	[2]	[2]	[2]	76.0	81.1	122.7
Biochemical Oxygen Demand (5-Day @ 20 Deg. C) (BOD_5)	mg/L	30[4]	45[4]	[3]	117	128	165
	lbs/day	22,518[4]	33,777[4]	[3]	62,791	67,205	91,670
	% Removal	The average monthly percent removal shall not be less than 85 percent.[4]			37[6]		
	mg/L	119[5]	122[5]	[3]	117	128	165
	lbs/day	89,414[5]	91,594[5]	[3]	62,791	67,205	91,670
	% Removal	The average monthly percent removal shall not be less than 30 percent.[5]			37[6]		
Total Suspended Solids (TSS)[4]	mg/L	30[4]	45[4]	[3]	57	66	101
	lbs/day	22,518[4]	33,777[4]	[3]	21,487	23,391	29,024
	% Removal	The average monthly percent removal shall not be less than 85 percent.[4]			69[6]		
	mg/L	48[5]	50[5]	[3]	57	66	101
	lbs/day	36,349[5]	37,403[5]	[3]	21,487	23,391	29,024
	% Removal	The average monthly percent removal shall not be less than 60 percent.[5]			69[6]		

MGD – Million Gallons per Day
[1] Source: Monthly Discharge Monitoring Reports (DMRs) and daily data submitted by the Permittee from January 2015 through February 2019. This data represents the highest reported value over the monitoring period specified.
[2] The Permittee shall monitor and report the average monthly, average weekly, and maximum daily flow.
[3] The Permittee shall monitor and report the parameter analytical test results.
[4] Effluent limitations contained in the 2018 Permit.
[5] Interim effluent limitations contained in the 2010 Consent Decree. Interim effluent limitations are applicable until deadlines established in the 2010 Consent Decree. See discussion of the 2010 Consent Decree in section B.7. of the Fact Sheet.
[6] Data represents minimum percent removal reported.

Table F-3. Historic Effluent Limitations and Monitoring Data – Outfall Serial No. 001

Parameter	Units	Effluent Limitation			Reported Data[1]		
		Average Annual	Average Monthly	Maximum Daily	Average Annual	Average Monthly	Maximum Daily
pH	standard units	Not less than 6.0 nor greater than 9.0			6.8 – 7.4		
Chronic Toxicity *Tripneustes gratilla*[3]	Pass/Fail	--	--	Pass	--	--	Pass: 16 Fail: 88
Chronic Toxicity *Ceriodaphnia dubia*[4]	Pass/Fail	--	--	Pass	--	--	Pass: 2 Fail: 0
Chronic Toxicity *Atherinops affinis*[4]	Pass/Fail	--	--	Pass	--	--	Pass: 1 Fail: 0
Dieldrin	µg/L	0.0138[5]	--	0.420	0.049	0.56	[7]
	lbs/day	0.0103[6]	--	0.315	0.026	0.30	[7]
Enterococcus	CFU/100 mL	--	19,250	28,730	--	12,445	94,000
Total Oil and Grease	mg/L	--	--	[2]	--	--	41.9
	lbs/day	--	--	[2]	--	--	13,595
Total Petroleum Hydrocarbons	mg/L	--	[2]	[2]	--	8.3	18.8
	lbs/day	--	[2]	[2]	--	4,423	9,914
Fats, Oils, and Grease	mg/L	--	[2]	[2]	--	10.1	37.9
	lbs/day	--	[2]	[2]	--	5,544	20,742
Temperature	°C	--	[2]	[2]	--	28.9	30
Ammonia Nitrogen	µg/L	[2]	[2]	--	19,896	22,650	--
	lbs/day	[2]	[2]	--	10,461	11,173	--
Total Nitrogen	µg/L	[2]	[2]	--	27,053	31,350	--
	lbs/day	[2]	[2]	--	14,357	15,738	--
Total Phosphorus	µg/L	[2]	[2]	--	3066	3,510	--
	lbs/day	[2]	[2]	--	1,635	1,822	--
Nitrate + Nitrite Nitrogen (NO_3+NO_2)	µg/L	[2]	[2]	--	73	290	--
	lbs/day	[2]	[2]	--	114	168	--
Turbidity	NTU	[2]	[2]	--	95.0	144.0	--

1 Source: Highest reported values from monthly DMRs submitted by the Permittee from January 2015 through February 2019.
2 No effluent limitations. Only monitoring and reporting required.
3 Chronic toxicity tests for the Permittee are reported as "Pass" or "Fail" as discussed in Part B.3 of the draft permit and Part D.2.g.of this Fact Sheet. From January 2015 through November 2019, the Permittee reported chronic toxicity, as measured using *Tripneustes gratilla*, with 21 results as "Pass" and 90 results as "Fail".
4 The 2018 Permit incorporated two additional test species: *Ceriodaphnia dubia* and *Atherinops affinis*. The Permittee shall test one species of the three chronic toxicity test species (*T.gratilla*, *C.dubia*, and *A.affinis*) each calendar month such that each species is tested at least once per quarter.
5 If the Minimum Level (ML) is greater than 0.0138 µg/l, the discharge limitation shall be the value of the ML for the specific laboratory analysis result.
6 If the Minimum Level (ML) is greater than 0.0138 µg/l, the discharge limitation shall be equal to 8.34 * ML (mg/l) * flow (MGD).
7 Minimum Dieldrin measurement frequency is once per month.

6. Compliance Summary

The following table lists effluent limitation violations as identified in the monthly, quarterly, and annual DMRs submitted by the Permittee from December 2015 to October 2018.

Table F-4. Summary of Compliance History

Monitoring Period	Violation Type	Pollutant	Reported Value	Permit Limitation	Units
August 6, 2018	Daily Max	Dieldrin	0.56	0.18	µg/L
August 6, 2018	Daily Max	Dieldrin	0.30	0.14	lbs/day
March 2016 – August 2018	Daily Max	Enterococci	[1]	18,000	CFU/100 mL
March 2015	Weekly Average	BOD_5	123	122	mg/L
July 2015	Weekly Average	BOD_5	123	122	mg/L
August 2015	Weekly Average	BOD_5	125	122	mg/L
August 2015	Weekly Average	BOD_5	128	122	mg/L
December 2015	Weekly Average	BOD_5	123	122	mg/L
December 2015 – May 2017	Monthly Average	TSS	[2]	48	mg/L
December 2015 – September 2017	Weekly Average	TSS	[3]	50	mg/L
January 2015 – October 2018	Daily Max	Chronic Toxicity	[4]	Pass	Pass/Fail

[1] Enterococci samples exceeded daily maximum effluent limitation 13 times from March 2016 through August 2018.
[2] TSS samples exceeded monthly average effluent limitation 9 times from December 2015 through May 2017.
[3] TSS samples exceeded weekly average effluent limitation 35 times from December 2015 through September 2017.
[4] Chronic toxicity samples exceeded daily maximum effluent limitation 88 times from January 2015 through October 2018.

7. Consent Decree and Planned Changes

On December 17, 2010, a Consent Decree (2010 Consent Decree) was entered in *United States of America v. City and County of Honolulu* to resolve litigation between the Permittee, the United States, State of Hawaii, and certain other parties. Under the 2010 Consent Decree, collection system work is to occur through 2020 and the Permittee is required to complete various plant upgrades necessary to comply with secondary treatment standards at two of its wastewater treatment plants, including the SIWWTP. The SIWWTP is to complete construction of the upgrades no later than December 31, 2038. Until the facility achieves compliance with secondary treatment standards, the Permittee is subject to interim effluent limitations for BOD_5 and TSS. The deadlines for completing the upgrades are as follows:

Table F-5. 2010 Consent Decree Deadlines

Deadline	Requirement
1/1/2022	Execute a construction contract, and issue a notice to proceed with construction.
1/1/2024 to 12/31/2025	If required, submit a proposal and financial analyses to extend deadline to no later than 12/31/2038.
1/1/2030	If the 2022 notice to proceed does not include all work due to phasing of the project, execute construction contract(s) and issue notice(s) to proceed for remaining work.
12/31/2035	Complete construction of facilities, unless proposal for deadline extension was approved.
Extended deadline no later than 12/31/2038	If proposal for extended deadline was approved, complete construction of facilities by that deadline.

C. Applicable Plans, Policies, and Regulations

1. Hawaii Administrative Rules, Chapter 11-54

On November 12, 1982, the Hawaii Administrative Rules Title 11, Department of Health, Chapter 54 became effective (hereinafter HAR Chapter 11-54). HAR Chapter 11-54 was amended and compiled on October 6, 1984; April 14, 1988; January 18, 1990; October 29, 1992; April 17, 2000; October 2, 2004; June 15, 2009; October 21, 2012; December 6, 2013; and the most recent amendment was on November 15, 2014. HAR Chapter 11-54 establishes beneficial uses and classifications of State waters, the State antidegradation policy, zones of mixing standards, and water quality criteria that are applicable to Honolulu Harbor.

Requirements of the draft permit implement HAR Chapter 11-54.

2. Hawaii Administrative Rules, Chapter 11-55

On November 27, 1981 HAR Title 11, Department of Health, Chapter 55 became effective (hereinafter HAR Chapter 11-55). HAR Chapter 11-55 was amended and compiled on October 29, 1992; September 22, 1997; January 6, 2001; November 7, 2002; August 1, 2005; October 22, 2007; June 15, 2009, October 21, 2012, and the most recent amendment was on November 15, 2014, July 13, 2018, with the most recent amendment on February 9, 2019. HAR Chapter 11-55 establishes standard permit conditions and requirements for NPDES permits issued in Hawaii.

Requirements of the draft permit implement HAR Chapter 11-55.

3. State Toxics Control Program

NPDES Regulations at 40 CFR 122.44(d) require permits to include water quality-based effluent limitations (WQBELs) for pollutants, including toxicity, that are or may be discharged at levels that cause, have reasonable potential to cause, or contribute to an exceedance of a water quality standard. The *State Toxics Control Program: Derivation of Water Quality-Based Discharge Toxicity Limits for Biomonitoring and Specific Pollutants* (hereinafter, STCP) was finalized in April 1989, and provides guidance for the development of water quality-based toxicity control in NPDES permits by developing the procedures for translating water quality standards in HAR Chapter 11-54, into enforceable NPDES permit limitations. The STCP identifies procedures for calculating permit limitations for specific toxic pollutants for the protection of aquatic life and human health. Guidance contained in the STCP was used to determine effluent limitations in the draft permit.

4. 40 CFR Part 133 – Secondary Treatment Regulation

40 CFR Part 133 provides technology-based regulations and effluent limitations applicable to facilities that provide secondary treatment of wastewater.

D. Rationale for Effluent Limitations and Discharge Specifications

The CWA requires point source Permittees to control the amount of conventional, non-conventional, and toxic pollutants that are discharged into the waters of the United States. The control of pollutants discharged is established through effluent limitations and other requirements in NPDES permits. NPDES regulations establish two (2) principal bases for effluent limitations. At 40 CFR 122.44(a), permits are required to include applicable technology-based limitations and standards; and at 40 CFR 122.44(d), permits are required to include WQBELs to attain and maintain applicable numeric and narrative water quality criteria to protect the beneficial uses of the receiving water. When numeric water quality objectives have not been established, but a discharge has the reasonable potential to cause or contribute to an excursion above a narrative criterion, WQBELs may be established using one (1) or more of three (3) methods described at 40 CFR 122.44(d) – 1) WQBELs may be established using a calculated water quality criterion derived from a proposed state criterion or an explicit state policy or regulation interpreting its narrative criterion; 2) WQBELs may be established on a case-by-case basis using EPA criteria guidance published under CWA Section 304(a); or 3) WQBELs may be established using an indicator parameter for the pollutant of concern.

1. Technology-Based Effluent Limitations (TBELs)

a. Scope and Authority

Section 301(b) of the CWA and implementing EPA permit regulations at 40 CFR 122.44 require that permits include conditions meeting applicable technology-based requirements at a minimum, and any more stringent effluent limitations necessary to meet applicable water quality standards. The discharge authorized by this draft permit must meet minimum federal technology-based requirements based on Secondary Treatment Standards at 40 CFR 133.

Regulations promulgated in 40 CFR 125.3(a)(1) require technology-based effluent limitations for municipal Permittees to be placed in NPDES permits based on Secondary Treatment Standards or Equivalent to Secondary Treatment Standards.

The Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) established the minimum performance requirements for publicly owned treatment works (POTWs) [defined in section 304(d)(1)]. CWA Section 301(b)(1)(B) requires that such treatment works must, at a minimum, meet effluent limitations based on secondary treatment as defined by the EPA Administrator.

Based on this statutory requirement, EPA developed secondary treatment regulations, which are specified in 40 CFR 133. These technology-based regulations apply to all municipal wastewater treatment plants and identify the minimum level of effluent quality attainable by secondary treatment in terms of 5-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), and pH.

b. Applicable Technology-Based Effluent Limitations

At 40 CFR 133 in the Secondary Treatment Regulations, EPA has established the minimum required level of effluent quality attainable by secondary treatment shown in Table F-6 below. The standards in Table F-6 are applicable to the facility and therefore established in the draft permit as technology-based effluent limitations.

Table F-6. Applicable Technology-Based Effluent Limitations

Parameter	Units	30-Day Average	7-Day Average
BOD_5[1]	mg/L	30	45
TSS[1]	mg/L	30	45
pH	standard units	6.0 – 9.0	

[1] The 30-day average percent removal shall not be less than 85 percent.

However, Paragraph 32.c of the 2010 Consent Decree establishes interim effluent limitations and monitoring requirements for Sand Island for flow, BOD_5 and TSS. Paragraph 32 of the 2010 Consent Decree specifically states, *"From the Effective Date of this Consent Decree until the final compliance milestone set pursuant to Paragraph 31 for the Sand Island WWTP, CCH shall comply with the requirements and interim effluent limits for TSS and BOD_5 set forth . . . for the Sand Island WWTP, notwithstanding any final effluent limitations for TSS and BOD_5 set forth in CCH's applicable NPDES permit for the Sand Island WWTP; provided, however, that this Consent Decree shall not affect the force or effect of any other effluent limitations, or monitoring and reporting requirements, or any other terms and conditions of its applicable NPDES permit."*

The DOH is recognizing the interim limits for BOD_5 and TSS as set forth in the Consent Decree, as those interim limits were performance-based and established to ensure that a minimum level of treatment is maintained until the treatment plant is upgraded to full secondary treatment.

2. Water Quality-Based Effluent Limitations (WQBELs)

a. Scope and Authority

NPDES Regulations at 40 CFR 122.44(d) require permits to include WQBELs for pollutants, including toxicity, that are or may be discharged at levels that cause, have reasonable potential to cause, or contribute to an exceedance of a water quality standard, including numeric and narrative objectives within a standard (reasonable potential). As specified in 40 CFR 122.44(d)(1)(i), permits are required to include WQBELs for all pollutants "which the Director determines are or may be discharged at a level that will cause, have reasonable potential to cause, or contribute to an excursion above any state water quality standard."

The process for determining reasonable potential and calculating WQBELs, when necessary, is intended to protect the receiving waters as specified in HAR Chapter 11-54. When WQBELs are necessary to protect the receiving waters, the DOH has followed the requirements of HAR Chapter 11-54, the STCP, and other applicable State and federal guidance policies to determine WQBELs in the draft permit.

Where reasonable potential has been established for a pollutant, but there is no numeric criterion or objective for the pollutant, WQBELS must be established in accordance with the requirements of 40 CFR 122.44(d)(1)(vi), using (1) EPA criteria guidance under CWA Section 304(a), supplemented where necessary by other relevant information; (2) an indicator parameter for the pollutant of concern; or (3) a calculated numeric water quality criterion, such as a proposed state criterion or policy interpreting the state's narrative criterion, supplemented with other relevant information.

b. Applicable Water Quality Standards

The beneficial uses and water quality standards that apply to the receiving waters for this discharge are from HAR Chapter 11-54.

(1) HAR Chapter 11-54. HAR Chapter 11-54 specifies numeric aquatic life standards for 72 toxic pollutants and human health standards for 60 toxic pollutants, as well as narrative standards for toxicity. Effluent limitations and provisions in the draft permit are based on available information to implement these standards.

(2) Water Quality Standards. The facility discharges to the Mamala Bay, Pacific Ocean, which is classified as a Marine Class A Wet Open Coastal Waters in HAR Chapter 11-54. As specified in HAR Chapter 11-54, saltwater standards apply when the dissolved inorganic ion concentration is above 0.5 parts per thousand. As such, a reasonable potential analysis (RPA) was conducted using saltwater standards. Additionally, human health water quality standards were also used in the RPA to protect human health. Where both saltwater standards and human health standards are available for a particular pollutant, the more stringent of the two (2) was used in the RPA.

40 CFR 122.45(c) requires effluent limitations for metals to be expressed as total recoverable metal. Since water quality standards for metals are expressed in the dissolved form in HAR Chapter 11-54, factors or translators must be used to convert metal concentrations from dissolved to total recoverable. Default EPA conversion factors were used to convert the applicable dissolved criteria to total recoverable.

(3) Receiving Water Hardness. HAR Chapter 11-54 contains water quality criteria for six (6) metals that vary as a function of hardness in freshwater. A lower hardness results in a lower freshwater water quality standard. The metals with hardness dependent standards include cadmium, copper, lead, nickel, silver, and zinc. Ambient hardness values are used to calculate freshwater water quality standards that are hardness dependent. Since saltwater standards are used for the RPA, the receiving water hardness was not taken into consideration when determining reasonable potential.

c. Determining the Need for WQBELs

NPDES regulations at 40 CFR 122.44(d) require effluent limitations to control all pollutants which are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard. Assessing whether a pollutant has reasonable potential is the fundamental step in determining whether or not a WQBEL is required.

(1) Reasonable Potential Analysis (RPA).

Toxic Pollutants Using the methods prescribed in EPA's *Technical Support Document for Water Quality-Based Toxics Control* (the TSD, EPA/505/2-90-001, 1991), the effluent data for toxic pollutants discharged at Outfall Serial No. 001 was analyzed to determine if the discharge demonstrates reasonable potential to exceed the applicable WQS. The RPA for pollutants with WQS specified in HAR Chapter 11-54-4, based on the TSD, combines knowledge of effluent variability as estimated by a coefficient of variation with the uncertainty due to a limited number of data to project an estimated maximum receiving water concentration as a result of the effluent. The estimated receiving water concentration is calculated as the upper bound of the expected lognormal distribution of effluent concentrations at a high confidence level. The projected maximum receiving water concentration, after consideration of dilution, is then compared to the WQS in HAR Chapter 11-54, to determine if the pollutant has reasonable potential. The projected maximum receiving water concentration has reasonable potential if it cannot be demonstrated with a high confidence level that the upper bound of the lognormal distribution of effluent concentrations is below the receiving water standards.

The projected maximum receiving water concentration for non-carcinogens is calculated using the following equation:

Maximum RWC = (Multiplier * X_{Max}) / (D)

Where:

Maximum RWC	=	Maximum receiving water concentration
Multiplier	=	Multiplier calculated using methods in Section 3.3.2 of the TSD (99% multiplier for municipal facilities and 95% multiplier for industrial facilities)
X_{Max}	=	Highest observed pollutant concentration (µg/L)
D	=	Parts receiving water to effluent

The initial dilution at the ZID is used as D for determining reasonable potential for non-carcinogens.

The projected maximum receiving water concentration for carcinogens is calculated using the following equation:

Maximum AARWC = AX_{Max} / (D)

Where:

Maximum AARWC	=	Maximum annual average receiving water concentration
AX_{Max}	=	Highest observed annual average pollutant concentration (µg/L)
D	=	Parts receiving water to effluent

The average dilution at the ZID is used as D for determining reasonable potential for carcinogens.

Due to the long exposure time associated with human health criteria for carcinogens (e.g. 70 years), and because the human health criteria for carcinogens is expressed as an annual average, where carcinogens were flagged for reasonable potential using the TSD method, a second step in the RPA was performed to account for the longer exposure period. If a carcinogen was flagged using the TSD method, annual averages over calendar years were compared directly to the water quality criteria, after mixing, to evaluate reasonable potential. The carcinogens triggered for further evaluation by the TSD RPA procedures were dieldrin and chlordane.

The reasonable potential analysis followed the guidance set forth by the EPA through its Region 10 in *EPA Region 10 Guidance for WQBELs Below Analytical Detection/Quantitation Level*, EPA, 1996 in its treatment of data that is detected at limits below the Minimum Level (i.e., the level at which the parameter may be accurately quantified) or the Detection Limit. Where the maximum annual average concentration is greater than the applicable water quality standard from HAR Chapter 11-54, then reasonable potential exists for the pollutant, and effluent limitations are established.

Nutrients For nutrients, the most stringent WQS specified in HAR Chapter 11-54-6, are provided as geometric means and exceedances of these WQS are less sensitive to effluent variability. The RPA was conducted by doing a direct comparison of the maximum annual geometric mean of data analyzed for each ZOM station to the applicable geometric mean listed in HAR Chapter 11-54-6. Dilution is not taken into account because the data from samples collected in the receiving water ZOM stations were used.

(2) Effluent Data. The RPA for this draft permit is based on the effluent monitoring data submitted to the DOH in DMRs. The data period for chlordane and dieldrin is sufficient to accurately characterize the anticipated effluent quality and account for variability within the effluent.

(3) Dilution. On June 29, 2017, the Permittee submitted a dilution study for the facility using NRFIELD, the latest version of the Visual PLUMES model for dilution calculations ("2017 Sand Island Dilution Study," Appendix 1). The model evaluated the minimum dilution and average dilution in the initial mixing zone where jet and buoyant near field processes occur, as well as the far field dilution (with and without the bacterial decay process) using the most appropriate available data.

For initial mixing, the model considered more recent ambient and effluent data and model input values that accurately reflect current operating and environmental conditions, including:

- ocean current measurements recorded at 20-minute intervals taken over a 27 month period from January 22, 2007 through April 19, 2009;
- quarterly ambient CTD data from 2012 through 2016;
- effluent temperature and salinity data; and
- peak 3-hour flow rate data from 2012-2016 as well as the average growth rate for each year to establish the projected 3 hour peak flow of 97.2 mgd for 2021.

The Permittee's 2017 Sand Island Dilution Study appears to represent ambient conditions accurately. For the development of this permit, DOH is using the critical short term initial dilution of 221:1 for chronic aquatic toxicity and fish consumption criteria for non-carcinogens, and 550:1 for fish consumption criteria for carcinogens.

HAR Chapter 11-54-9, allows the use of a ZOM to demonstrate compliance with WQS. ZOMs consider initial dilution, dispersion, and reactions from substances which may be considered to be pollutants. For Section 11-54-6 parameters, reasonable potential to contribute to an exceedance of WQS is most reasonably assessed by comparing monitoring data at the edge of the ZOM to the applicable WQS. If an annual geometric mean at the edge of a ZOM exceeds the applicable WQS, the Permittee is determined to have reasonable potential for the pollutant. If an exceedance of WQS is not observed at the edge of the ZOM, it is assumed that sufficient dilution and assimilative capacity exists to meet WQS at the edge of the ZOM.

The 2017 Sand Island Dilution Study was used to establish end-of-pipe effluent limitations. Where assimilative capacity does not exist, it is not appropriate to grant a ZOM and/or dilution, and an end-of-pipe criteria-based effluent limitation must be established that is protective of WQS.

Assimilative capacity for pollutants with reasonable potential is evaluated for Section 11-54-6 pollutants by aggregating all ZOM control station data annually and comparing the annual geometric means to the applicable WQS. If an annual geometric mean exceeds 90 percent of the WQS, assimilative capacity is determined to be insufficient and dilution may not be granted.

(4) Summary of RPA Results. The maximum effluent concentrations from the DMRs over the previous permit term and the NPDES Application Form 2C, maximum projected receiving water concentration after dilution calculated using methods from the HIP, the applicable HAR Section 11-54-4(c)(3) and 11-54-6(b)(3) water quality standard, and result of the RPA for pollutants discharged from Outfall Serial No. 001 is presented in Table F-8, below. The maximum projected concentrations for toxics specified in HAR Section 11-54-4 have been revised to reflect available dilution. For nutrients and water quality standards specified in HAR Section 11-54-6(b)(3), dilution, where available, has been accounted for within the summarized applicable water quality standard. Only pollutants detected in the discharge are presented in Table F-8. All other pollutants were not detected and therefore, no reasonable potential exists.

Data for toxic pollutants is based on semi-annual reports from 2015 through 2019. However, the effluent concentration values provided for dieldrin and chlordane represent annual averages from January 2015 through December 2019. When effluent results were reported below the method detection limit for the analytical method, zero was used for those data points when determining an annual average. The use of zero for results below the method detection limit for the purposes of an RPA is consistent with EPA Region 10's *Guidance for WQBELs Below Analytical Detection/Quantification Level*, EPA, 1996.

Reasonable potential for ammonia nitrogen was evaluated using recent data from January 2015 through December 2019. Because the criteria for ammonia nitrogen is calculated using a geometric mean, the use of zero for non-detect results, consistent with EPA Region 10 guidance, is not possible. The substitution method was utilized to account for non-detects when calculating a geometric mean. DOH selected a substitution value of one-quarter of the method detection limit for non-detects, which is consistent with the intent of the EPA guidance, but still allows for the calculation of a geometric mean. Ammonia nitrogen geometric means were calculated using available ZOM data aggregated for each calendar year. Using this RPA method for ammonia nitrogen with recent data from 2015 through 2019, reasonable potential does not exist for ammonia nitrogen.

Table F-8a. Summary of RPA Results – Metals, Total Recoverable

Parameter	Units	Number of Samples	Dilution	Maximum Effluent Concentration	Maximum Projected Concentration	Applicable Water Quality Standard	RPA Results
Antimony, Total Recoverable	µg/L	20	221	1.8	0.018	15,000	No
Arsenic, Total Recoverable	µg/L	18	221	1.6	0.032	36	No
Beryllium, Total Recoverable	µg/L	18	550	0.37	0.0007	0.038	No
Cadmium, Total Recoverable	µg/L	20	221	0.068	0.0007	9.4	No
Chromium, Total Recoverable	µg/L	20	221	4.2	0.0264	50	No
Copper, Total Recoverable	µg/L	16	221	120	1.24	3.5	No
Lead, Total Recoverable	µg/L	20	221	1.7	0.023	5.9	No
Mercury, Total Recoverable	µg/L	20	221	0.1	0.0023	0.025	No
Nickel, Total Recoverable	µg/L	17	221	11	0.081	8.4	No
Selenium, Total Recoverable	µg/L	13	221	0.08	0.001	71	No
Silver, Total Recoverable	µg/L	20	221	0.2	0.0014	2.7	No
Thallium, Total Recoverable	µg/L	20	221	0.24	0.007	16	No
Zinc, Total Recoverable	µg/L	13	221	45	0.32	91	No

Table F-8b. Summary of RPA Results – Organonitrogen

Parameter	Units	Number of Samples	Dilution	Maximum Effluent Concentration	Maximum Projected Concentration	Applicable Water Quality Standard	RPA Results
2,4-dinitrotoluene	µg/L	20	550	1	0.0018	3	No
2,6-dinitrotoluene	µg/L	20	550	0.09	0.00016	3	No

Table F-8c. Summary of RPA Results – Pesticides

Parameter	Units	Number of Samples	Dilution	Maximum Effluent Concentration	Maximum Projected Concentration	Applicable Water Quality Standard	RPA Results
Chlordane	µg/L	94	550	0.068	0.00012	0.00016	No[1]
Demeton	µg/L	19	221	0.048	0.00052	0.1	No
Dieldrin	µg/L	50	550	0.049	0.000089	0.000025	Yes[1]
Guthion	µg/L	19	221	0.13	0.0014	0.01	No
Malathion	µg/L	19	221	0.053	0.0006	0.1	No
Parathion	µg/L	19	221	0.02	0.00021	ns	No

Table F-8d. Summary of RPA Result – Phenols

Parameter	Units	Number of Samples	Dilution	Maximum Effluent Concentration	Maximum Projected Concentration	Applicable Water Quality Standard	RPA Results
Phenol	µg/L	20	221	6.8	0.046	170	No

Table F-8e. Summary of RPA Results – Phthalates

Parameter	Units	Number of Samples	Dilution	Maximum Effluent Concentration	Maximum Projected Concentration	Applicable Water Quality Standard	RPA Results
Bis(2-Ethylhexyl) Phthalate	µg/L	20	221	5.69	0.15	16,000	No
Dibutyl Phthalate	µg/L	20	221	0.85	0.0088	5,000	No
Diethyl Phthalate	µg/L	20	221	3.6	0.051	590,000	No
Butyl benzyl Phthalate	µg/L	20	550	0.39	0.00071	ns	No

Table F-8f. Summary of RPA Results – Polynuclear Aromatic Hydrocarbons

Parameter	Units	Number of Samples	Dilution	Maximum Effluent Concentration	Maximum Projected Concentration	Applicable Water Quality Standard	RPA Results
Polynuclear Aromatic Hydrocarbons	µg/L		550	All parameters not detected.	0	0.01	No

Table F-8g. Summary of RPA Results – Volatile Organics

Parameter	Units	Number of Samples	Dilution	Maximum Effluent Concentration	Maximum Projected Concentration	Applicable Water Quality Standard	RPA Results
Benzene	µg/L	19	550	0.81	0.0015	13	No
Bromodichloro methane	µg/L	19	550	0.035	0.00006	0.27	No
Bromoform	µg/L	19	550	0.105	0.00019	4.3	No
Bromomethane	µg/L	19	221	0.04	0.00043	48	No
Chlorobenzene	µg/L	19	221	0.09	0.0011	860	No
Chloroform	µg/L	19	550	1.09	0.002	5.1	No
Chloromethane	µg/L	19	550	0.065	0.00012	ns	No
1,2-Dichlorobenzene	µg/L	19	550	0.11	0.00020	660	No
1,4-Dichlorobenzene	µg/L	19	550	0.75	0.0014	660	No
1,2-Dichloroethane	µg/L	19	550	0.0125	0.00002	79	No
Ethylbenzene	µg/L	19	221	0.27	0.0024	140	No
Methylene Chloride	µg/L	19	550	0.115	0.00021	4.7	No
Tetrachloro ethylene	µg/L	19	550	0.355	0.0006	2.9	No
Toluene	µg/L	19	221	1.3	0.008	2,100	No
Trichloroethylene	µg/L	19	550	0.095	0.00017	26	No

Table F-8h. Summary of RPA Results – Other Toxic Pollutants

Parameter	Units	Number of Samples	Dilution	Maximum Effluent Concentration	Maximum Projected Concentration	Applicable Water Quality Standard	RPA Results
Cyanide, Total Recoverable	µg/L	20	221	Not Detected	0	1.0	No

Table F-8i. Summary of RPA Results – Nutrients

Parameter	Units	Number of Samples per Year	Dilution	Maximum Annual Geometric Mean Across All ZOM Stations	Maximum Projected Concentration	Applicable Water Quality Standard	RPA Results
Total Nitrogen	µg/L	48	NA	110.31[2]	NA	150.00	No
Ammonia Nitrogen	µg/L	48	NA	2.86[2]	NA	3.5	No
Nitrate + Nitrite Nitrogen	µg/L	48	NA	1.15[2]	NA	5.0	No
Total Phosphorus	µg/L	48	NA	7.65[2]	NA	20.00	No

[1] Because the annual average analysis is the determining factor in evaluating reasonable potential for chlordane and dieldrin, the annual data is summarized in this table for these two parameters.
[2] Receiving water concentrations.

(5) Reasonable Potential Determination.

(a) Constituents with Limited Data. In some cases, reasonable potential cannot be determined because all effluent data for some parameters were reported as below the minimum detection level. The draft permit requires the Permittee to continue to monitor for these constituents in the effluent using analytical methods that provide the lowest available detection limitations. When additional data become available, further RPAs will be conducted to determine whether to add numeric effluent limitations to this permit or to continue monitoring. Data for the following parameters were not available:

- Carbon Tetrachloride
- Chlorodibromomethane
- Acenaphthylene
- Acrylonitrile
- Anthracene
- Benzo(b)Fluoranthene
- Benzo(k)Fluoranthene
- Benzo(a)Pyrene
- Bis(2-Chloroethyl)Ether
- Bis(2-Chloroethoxy)Methane
- Bis(2-Chloroisopropyl)Ether
- Chrysene
- Dimethyl Phthalate
- 1,2-Diphenylhydrazine
- beta-Endosulfan

- alpha-Endosulfan
- Fluoranthene
- Fluorene
- Hexachlorocyclopentadiene
- Hexachloroethane
- Indeno(1,2,3-cd) Pyrene
- Isophorone
- N-Nitrosodimethylamine
- N-Nitrosodi-n-Propylamine
- N-Nitrosodiphenylamine
- Nitrobenzene
- Para Chlorometa Cresol
- Phenanthrene
- Pyrene
- 1,1-Dichloroethane
- 1,1-Dichloroethylene
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- 1,1,2,2-Tetrachloroethane
- Benzo(ghi)Perylene
- Benzo(a)Anthracene
- 1,2-Dichloropropane
- 1,2-Trans-Dichloroethylene
- 1,2,4-Trichlorobenzene
- Dibenzo(a,h)Anthracene
- 1,3-Dichlorobenzene
- 2-Chloroethylvinyl Ether
- 2-Chloronaphthalene
- 2-Chlorophenol
- 2-Nitrophenol
- Di-n-Octyl Phthalate
- 2,4-Dichlorophenol
- 2,4-Dimethylphenol
- 2,4-Dinitrophenol
- 2,4,6-Trichlorophenol
- 4-Bromophenyl Phenyl Ether
- 4-Chlorophenyl Phenyl Ether
- 4-Nitrophenol
- 2-Methyl- 4,6-Dinitrophenol
- PCB-1016
- 2,3,7,8 TCDD
- Naphthalene
- Pentachlorophenol
- Benzidine

- Vinyl Chloride
- 4,4'-DDE
- Aldrin
- alpha-BHC
- beta-BHC
- delta-BHC
- gamma-BHC
- Endrin
- Toxaphene
- Heptachlor
- Heptachlor Epoxide
- Methoxychlor
- PCBs
- Hexachlorobenzene
- Hexachlorobutadiene
- Mirex
- 1,3-Dichloropropylene
- Chloroethane

(b) **Pollutants with No Reasonable Potential.** WQBELs are not included in this draft permit for constituents listed in HAR Chapter 11-54-4(c)(3) and 11-54-6(b)(3) that do not demonstrate reasonable potential; however, monitoring for such pollutants is still required in order to collect data for future RPAs. Pollutants with no reasonable potential consist of those identified in Table F-8 or any pollutant identified in this section Part D.2.c.(5).(b) or not discussed in Parts D.2.c.(5).(a) or D.2.c.(5).(c) of this Fact Sheet.

(c) **Pollutants with Reasonable Potential.** The RPA indicated that dieldrin has reasonable potential to cause or contribute to an excursion above state water quality standards. Thus, WQBELs have been established in this draft permit at Outfall Serial No. 001 for dieldrin.

Due to the nature of the discharge (primary treated wastewater with ultraviolet (UV) disinfection), pathogens such as enterococcus are present in the effluent. Concentrations up to 94,000 CFU/100mL have been observed in the effluent, which exceed the applicable statistical threshold value (STV) of 130 CFU/100mL and the geometric mean criteria of 35 CFU/100mL with a dilution of 550:1 and 221:1, respectively (28,730 and 19,250 CFU/100mL, respectively). As such, reasonable potential for enterococcus has been determined and WQBELs have been established in the draft permit at Outfall Serial No. 001 for enterococcus.
The RPA for enterococcus is discussed in more detail in Part D.2.f of the Fact Sheet.

The WQBELs were calculated based on water quality standards contained in HAR Chapter 11-54 and procedures contained in the STCP, HIP, and HAR Chapter 11-54, as discussed in Part D.2.d, below.

d. WQBEL Calculations

Specific pollutant limits may be calculated for both the protection of aquatic life and human health.

(1) WQBELs based on Aquatic Life Standards. The HIP and STCP categorize a discharge from a facility into one of four categories: (1) marine discharges through submerged outfalls; (2) discharges without submerged outfalls; (3) discharges to streams; or (4) high-rate discharges. Once a discharge has been categorized, effluent limitations for pollutants with reasonable potential can be calculated, as described below.

(a) For marine discharges through submerged outfalls, the daily maximum effluent limitation shall be the product of the chronic water quality standard and the minimum dilution factor;

(b) For discharges without submerged outfalls, the daily maximum effluent limitation shall be the acute toxicity standard. ;

(c) For discharges to streams, the effluent limitation shall be the most stringent of the acute standard and the product of the chronic standard and dilution; and

(d) For high rate outfalls, the maximum limit for a particular pollutant is equal to the product of the acute standard and the acute dilution factor determined according to Section II.B.4 of the STCP.

(2) WQBELs based on Human Health Standards. The STCP specifies that the fish consumption standards are based upon the bioaccumulation of toxics in aquatic organisms followed by consumption by humans. Limits based on the fish consumption standards should be applied as 30-day averages for non-carcinogens and annual averages for carcinogens.

The discharge from this facility is considered a marine discharge through a submerged outfall. Therefore, for pollutants with reasonable potential, the draft permit establishes, on a pollutant by pollutant basis, daily maximum effluent limitations based on saltwater chronic aquatic life standard after considering dilution and average monthly effluent limitations for non-carcinogens or annual average effluent limitations for carcinogens based on the human health standard after considering dilution. WQBELs established in the draft permit are discussed in detail below.

(3) Calculation of Pollutant-Specific WQBELs

As discussed in Part D.2.c.(3) of this Fact Sheet, a minimum initial dilution of 221:1 and an average initial dilution of 550:1 have been established.

As discussed above as a second step screening for reasonable potential for non-carcinogens, the following equation was used:

$$\text{Maximum RWC} = (\text{Multiplier} * X_{Max}) / (D)$$

Where:

Maximum RWC	=	Maximum receiving water concentration
Multiplier	=	Multiplier calculated using methods in Section 3.3.2 of the TSD (99% multiplier for municipal facilities and 95% multiplier for industrial facilities)
X_{Max}	=	Highest observed pollutant concentration (µg/L)
D	=	Parts receiving water to effluent

The initial dilution at the ZID is used as D for determining reasonable potential for non-carcinogens.

The projected maximum receiving water concentration for carcinogens such as beryllium is calculated using the following equation:

$$\text{Maximum AARWC} = AX_{Max} / (D)$$

Where:

Maximum AARWC	=	Maximum annual average receiving water concentration
AX_{Max}	=	Highest observed annual average pollutant concentration (µg/L)
D	=	Parts receiving water to effluent

The average dilution at the ZID is used as D for determining reasonable potential for carcinogens.

If the projected maximum receiving water concentration is greater than the applicable water quality standard from HAR Chapter 11-54, then reasonable potential exists for the pollutant and effluent limitations are established. Pollutants with reasonable potential are discussed below in detail.

(a) Dieldrin

i. **Dieldrin Water Quality Standards.** The most stringent applicable water quality standard for dieldrin is the human health standard of 0.000025 µg/L, as specified in HAR Chapter 11-54.

ii. **RPA Results.** The last five (5) years of data were evaluated. The highest annual average for dieldrin between January 2015 and December 2019 was 0.04907µg/L. As discussed in Part D.2.c.(3), the facility is granted a dilution of 550:1 for human health carcinogens.

Maximum AARWC	=	AX_{Max} / (D)
	=	0.04907 µg/L / (1 + 550)
	=	0.000089 µg/L
HAR Section 11-54 Water Quality Standard	=	0.000025 µg/L

The projected maximum annual average receiving water concentration (0.000089 µg/L) exceeds the most stringent applicable water quality standard for this pollutant (0.000025 µg/L), demonstrating reasonable potential. Therefore, the draft permit establishes effluent limitations for dieldrin.

iii. **Dieldrin WQBELs.** WQBELs for dieldrin were calculated using STCP procedures and are based on the chronic aquatic life water quality standard and the human health standard. Based on the chronic aquatic life water quality standard and a dilution of 221:1, the draft permit establishes a daily maximum effluent limitation for dieldrin of 0.42 µg/L. The annual average effluent limitation of 0.0138 µg/L is based on the human health standard for carcinogens and a dilution of 550:1. However, in accordance with the Region 10, when the Minimum Level (ML) of the analysis is greater than the limitation of 0.0138 µg/L, the compliance level shall be the value of the ML for the specific laboratory analysis result.

iv. **Feasibility.** The highest daily maximum effluent concentration reported for dieldrin between January 2015 and December 2019 was 0.56 µg/L. Although this maximum effluent concentration is more than the maximum daily effluent limitation of 0.42 µg/L, most of the effluent concentrations are less than the maximum daily effluent limitation and MDL. Therefore, the DOH has determined that the facility will be able to comply with proposed maximum daily dieldrin effluent limitations.

Although the annual average effluent concentrations prior to 2015 are greater than the proposed annual average effluent limitation of 0.0138 µg/L and the MLs for dieldrin analysis (0.0187 µg/L and 0.0201 µg/L), most of the annual averages calculated since 2015 have been below these numbers and thus the DOH has determined that the facility should be able to comply with proposed annual average effluent limitation.

e. pH

The Permittee was previously granted a ZOM for pH to comply with water quality standards for open coastal waters in HAR Section 11-54-6(b)(3). Receiving water data from January 2015 through August 2019 indicate compliance with the water quality objectives for pH at the edge of the ZOM. The technology-based effluent limitations of between 6.0 to 9.0 at all times appear to be protective of water quality outside the ZOM and have been carried over.

f. Enterococcus

On November 15, 2014, the State amended HAR Section 11-54-8(b) to adopt new recreational water quality standards. The amended standards were approved by EPA on May 20, 2015. As amended, HAR Section 11-54-8(b) establishes recreational criteria for all State waters designed to protect the public from exposure to harmful levels of pathogens while participating in water-contact activities. The specified recreational criteria for all State waters are: a geometric mean of 35 CFU/100 mL over any thirty-day interval and a Statistical Threshold Value (STV) of 130 CFU/100 mL, which may not be exceeded in more than ten percent of samples taken within the same thirty-day interval in which the geometric mean is calculated.

The draft permit establishes a monthly average effluent limitation of 19,250 CFU/100 mL based on the enterococcus geometric mean of 35 CFU/100 mL and the average initial dilution of 550:1. It also establishes a daily maximum effluent limitation, which may not be exceeded in more than ten percent of samples taken within the same thirty-day interval in which the geometric mean was calculated, of 28,730 CFU/100 mL based on the STV of 130 mL and a minimum initial dilution of 221:1.

With the exception of the period from December 21, 2016 to December 27, 2016 where daily maximum enterococcus levels were high due to a temporary process upset, the highest daily maximum enterococcus effluent limit reported during the previous permit term was 22,000 CFU/100 mL (May 2018). In addition, during the previous permit term, and with the exception of December 2016, the facility has never exceeded the monthly geometric mean effluent limitation of 19,250 CFU/100 mL. Moreover, lower enterococcus concentrations are expected to be achieved following the upgrades to the treatment plant required by the 2010 Consent Decree. Therefore, DOH has determined that the facility will be able to meet the proposed daily maximum and monthly average enterococcus effluent limitations immediately.

g. Whole Effluent Toxicity (WET)

WET limitations protect receiving water quality from the aggregated toxic effect of a mixture of pollutants in an effluent. WET tests measure the degree of response of exposed aquatic test organisms to an effluent or receiving water. The WET approach allows for protection of the narrative criterion specified in HAR Chapter 11-54-4(c)(2) while implementing Hawaii's numeric WQS for toxicity. There are two types of WET tests – acute and chronic. An acute toxicity test is conducted over a short period of time and measures mortality. A chronic toxicity test is generally conducted over a longer period of time and may measure mortality, reproduction, or growth.

Test procedures for measuring toxicity to marine organisms of the Pacific Ocean are not provided at 40 CFR 136. Consistent with the Preamble to EPA's 2002 Final WET Rule, permit writers may include (under 40 CFR 122.41(j)(4) and 122.44(i)(iv)) requirements for the use of test procedures that are not approved at 40 CFR Part 136 on a permit-by-permit basis. The use of alternative methods for west coast facilities in Hawaii is further supported under 40 CFR 122.21(j)(5)(viii), which states, "West coast facilities in…, Hawaii,… are exempted from 40 CFR [P]art 136 chronic methods and must use alternative guidance as directed by the permitting authority."

EPA has issued applicable guidance for conducting chronic toxicity tests using *Tripneustes gratilla* ("*T. gratilla*") in Hawaiian Collector Urchin, *Tripneustes gratilla* (Hawa'e) Fertilization Test Method (Adapted by Amy Wagner, EPA Region 9 Laboratory, Richmond, CA from a method developed by George Morrison, EPA, ORD Narragansett, RI and Diane Nacci, Science Applications International Corporation, ORD Narragansett, RI) (EPA/600/R-12/022).

Reasonable potential for WET has been determined for Outfall Serial No. 001 and an effluent limitation must be established in accordance with 40 CFR 122.44(d)(1). Further, a WET effluent limitation and monitoring are necessary to ensure compliance with applicable WQS in HAR Chapter 11-54-4(c)(2).

The proposed WET limitation and monitoring requirements were incorporated into the draft permit in accordance with the EPA national policy on water quality-based permit limitations for toxic pollutants issued on March 9, 1984 (49 FR 9016), HAR Section 11-54-4(b)(2)(B), and EPA's National Pollutant Discharge Elimination System Test of Significant Toxicity Implementation Document (EPA 833-R-10-003, 2010).

Consistent with HAR Chapter 11-54-4(c)(2)(B), the previous permit established a chronic toxicity effluent limitation based on the TST hypothesis testing approach. The TST approach was designed to statistically compare a test species response to the in-stream waste concentration (IWC) and a control.

For continuous discharges through submerged outfalls, HAR Section 11-54-4(c)(4)(A) requires the no observed effect concentration (NOEC), expressed as a percent of effluent concentration, to not be less than 100 divided by the minimum dilution.

The following equation is used to calculate the IWC where the minimum dilution of 221:1 is granted (Outfall Serial No. 001):

$$\begin{aligned} IWC &= 100/\text{critical dilution factor} \\ &= 100/221 \\ &= 0.45\% \end{aligned}$$

For any one chronic toxicity test, the chronic WET permit limit that must be met is rejection of the null hypothesis (Ho):

IWC (percent effluent) mean response ≤ 0.75 × Control mean response.

A test result that rejects this null hypothesis is reported as “Pass”. A test result that does not reject this null hypothesis is reported as “Fail”

The acute and chronic biological effect levels (effect levels of 20% and 25%, respectively, or b values of 0.80 and 0.75, respectively) incorporated into the TST define EPA's unacceptable risks to aquatic organisms and substantially decrease the uncertainties associated with the results obtained from EPA's traditionally used statistical endpoints for WET. Furthermore, the TST reduces the need for multiple test concentrations which, in turn, reduces laboratory costs for Permittees while improving data interpretation.

A significant improvement offered by the TST approach over traditional hypothesis testing is the inclusion of an acceptable false negative rate. While calculating a range of percent minimum significant differences (PMSDs) provides an indirect measure of power for the traditional hypothesis testing approach, setting appropriate levels for β and α using the TST approach establishes explicit test power and provides motivation to decrease within test variability which significantly reduces the risk of under reporting toxic events (USEPA 2010[1]).

Taken together, these refinements simplify toxicity analyses, provide Permittees with the positive incentive to generate high quality data, and afford effective protection to aquatic life.

Under the draft permit, the Permittee will continue to be required to use three (3) test species for WET testing (specifically, *T. gratilla*, *C. dubia* and *Atherinops affinis*). Accordingly, the Permittee shall conduct chronic toxicity testing on three species in accordance with appropriate test methods, rotating the test species month by month such that each test species is tested once every quarter.

h. Summary of Final Effluent Limitations

In addition to the effluent limitations specified above, HAR Section 11-55-20 requires that daily quantitative limitations by weight be established where possible. Thus, in addition to concentration based-effluent limitations, mass-based effluent limitations (in pounds per day) have been established where applicable based on the following formula:

lbs/day = 8.34 * concentration (mg/L) * flow (MGD)

40 CFR 122.45(b)(1) requires that mass-based effluent limitations for POTWs be based on design flow, which, for the SIWWTP, is 90 MGD.

The following table lists final effluent limitations contained in the draft permit and compares them to effluent limitations contained in the 2018 Permit.

[1] U.S. Environmental Protection Agency. 2002a. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms (5th Edition). EPA 821-R-02-012. Washington, DC: Office of Water.

Table F-9. Summary of Final Effluent Limitations – BOD and TSS

Parameter	Units	Effluent Limitations Contained in the 2018 Permit[1]			Final Effluent Limitations[1]		
		Average Monthly	Average Weekly	Max Daily	Average Monthly	Average Weekly	Max Daily
Biochemical Oxygen Demand (BOD) (5-day @ 20 Deg. C)	mg/L	30	45	--	30	45	--
	lbs/day	22,518[2]	33,777[2]	--	22,518[2]	33,777[2]	--
	% Removal	The average monthly percent removal shall not be less than 85 percent.			The average monthly percent removal shall not be less than 85 percent.		
Total Suspended Solids (TSS)	mg/L	30	45	--	30	45	--
	lbs/day	22,518[2]	33,777[2]	--	22,518[2]	33,777[2]	--
	% Removal	The average monthly percent removal shall not be less than 85 percent.			The average monthly percent removal shall not be less than 85 percent.		

[1] These effluent limitations were replaced with interim effluent limitations in the 2010 Consent Decree.
[2] Based on a design flow of 90 MGD.

Table F-10. Summary of Final Effluent Limitations – All Other Pollutants

Parameter	Units	Effluent Limitations in the 2018 Permit			Final Effluent Limitations		
		Average Annual	Average Monthly	Max Daily	Average Annual	Average Monthly	Max Daily
Enterococci	CFU/ 100mL	--	19,250[1]	28,730[2]	--	19,250[1]	28,730[2]
pH[4]	s.u.	Not less than 6.0 and not greater than 9.0.			Not less than 6.0 and not greater than 9.0.		
Chronic Toxicity – *Ceriodaphnia Dubia*	TUc	--	-	Pass[3]	--	--	Pass[3]
Chronic Toxicity – *Tripneustes Gratilla*[3]	TUc	--	--	Pass[3]	--	--	Pass[3]
Chronic Toxicity – *Affnis*	TUc	--	--	Pass[3]	--	--	Pass[3]
Dieldrin	ug/L	0.0138	--	0.420	0.0138		0.420
	lbs/day	0.0103	--	0.315	0.0103		0.315

[1] Effluent limitation expressed as a monthly geometric mean.
[2] Effluent limitation expressed as maximum daily geometric mean.
[3] "Pass", as described in section D.2.g of this Fact Sheet.

i. Satisfaction of Anti-Backsliding Requirement

The CWA specifies that a renewed permit may not include effluent limitations that are less stringent than the previous permit unless a less stringent limitation is justified based on exceptions to the anti-backsliding provisions contained in CWA Sections 402(o) or 303(d)(4), or, where applicable, 40 CFR 122.44(l).

The effluent limitations established in the draft permit are consistent with State and federal anti-backsliding regulations because they are at least as stringent as those in the previous permit and are consistent with both State and federal anti-backsliding regulations.

j. Satisfaction of Antidegradation Requirements

The DOH established the State antidegradation policy in HAR Section 11-54-1.1, which incorporates the federal antidegradation policy at 40 CFR 131.12. The State antidegradation policy requires, among other factors, that the existing quality of Tier 2 waters be maintained and protected unless the degradation is necessary to accommodate important economic or social development in the area in which the waters are located.

The permitted discharge is consistent with antidegradation provisions of 40 CFR 131.12 and HAR Section 11-54-1.1, as the effluent limitations established in the draft permit are at least as stringent as the previous permit.

E. Rationale for Receiving Water and Zone of Mixing Requirements

1. Summary of ZOM Water Quality Standards and Monitoring Data

The following are effluent quality monitoring results for HAR Chapter 11-54, specific water quality criteria parameters that were provided in the ZOM Application on May 15, 2019, and applicable ZOM water quality criteria from HAR Section 11-54-6(b)(3).

Table F-11. ZOM Water Quality Criteria

Parameter	Units	Applicable Water Quality Standard
Total Nitrogen	µg/L	150[1]
Ammonia Nitrogen	µg/L	3.5[1]
Nitrate + Nitrite Nitrogen	µg/L	5.0[1]
Orthophosphate Phosphorus	µg/L	--
Total Phosphorus	µg/L	20[1]
Light Extinction Coefficient	k units	0.20
Chlorophyll a	µg/L	0.30[1]
Turbidity	NTU	0.50[1]
TSS	mg/L	--
pH	s.u.	[2]
Dissolved Oxygen	mg/L	[3]
Temperature	°C	[4]
Salinity	ppm	[5]

[1] Water quality standard expressed as a geometric mean.
[2] pH shall not deviate more than 0.5 units from a value of 8.1, except at coastal locations where and when freshwater from stream, storm drain, or groundwater discharge may depress the pH to a minimum level of 7.0.

[3] Dissolved oxygen shall not be less tha 75 percent saturation.
[4] Temperature shall not vary more than 1° Celcius from ambient conditions.
[5] Salinity shall not vary more than 10 percent from natural or seasonal changes considering hydrologic input and oceanographic factors.

2. Existing Receiving Water Limitations and Monitoring Data

a. Shoreline Stations

The following are a summary of the geometric mean values calculated from each shoreline monitoring location, reported in the monthly DMRs from January 2015 to December 2019.

Table F-12. Shoreline Monitoring Stations

Station	Highest Annual Geometric Mean[1]
	Enterococcus
	CFU/100 mL
S1	6.20
S2	1.26
S5	5.96
S7	8.78
S8	8.45
Water Quality Standard	35

[1] Source: Monthly DMRs submitted by the Permittee from January 2015 to December 2019.

b. Nearshore Stations

The following are a summary of the geometric mean values calculated from each near shore monitoring location, reported in the monthly and quarterly DMRs from January 2015 through December 2019.

Table F-13. Nearshore Monitoring Stations

Station	Highest Annual Geometric Mean[1]						
	Enterococcus	Nitrate+Nitrite Nitrogen[2]	Ammonia Nitrogen[2]	Total Nitrogen[2]	Total Phosphorus[2]	Turbidity[2]	Chlorophyll a[2]
	CFU/100 mL	µg/L	µg/L	µg/L	µg/L	NTU	µg/L
R1	0.99	--	9.60	--	11.37	--	1.00
R2	0.64	--	8.53	--	10.43	--	0.88
R3	1.44	--	8.14	--	10.34	--	0.59
C1A	0.41	2.18	4.17	105.30	7.73	0.32	0.19
C2A	0.46	1.37	3.54	111.20	7.59	0.27	0.16
C3A	0.50	1.62	2.76	107.04	7.65	0.26	0.22
C4	0.52	1.95	3.74	114.44	7.76	0.30	0.23
C5A	0.48	1.35	2.14	106.17	7.69	0.34	0.19
Water Quality Standard	35	5.0	3.5	150	20	0.50	0.30

1 Source: Monthly and Quarterly DMRs submitted by the Permittee from January 2015 through December 2019.
2 Reported geometric mean is the maximum geometric mean from the top, middle, and bottom sampling points at each station.

c. Offshore Stations

The following are a summary of the geometric mean values calculated from each offshore monitoring location on the edge of the ZOM, or reference station, reported in the monthly and quarterly DMRs from January 2015 through December 2019.

Table F-14. Offshore Monitoring Stations

Station[1]	Highest Annual Geometric Mean[2]						
	Enterococcus	Nitrate+Nitrite Nitrogen[2]	Ammonia Nitrogen[3]	Total Nitrogen[3]	Total Phosphorus[3]	Turbidity[3]	Chlorophyll a[3]
	CFU/100 mL	µg/L	µg/L	µg/L	µg/L	NTU	µg/L
D1	0.96	1.35	4.00	115.94	7.65	0.27	0.21
D2	0.96	0.94	2.77	110.37	8.03	0.24	0.16
D3A	0.76	0.97	3.76	113.85	7.63	0.24	0.15
D4	0.59	0.90	2.88	112.92	7.47	0.24	0.15
D5	0.55	0.85	2.98	109.06	7.45	0.29	0.17
E1	0.94	1.72	3.81	112.81	7.53	0.24	0.15
E2	0.66	1.78	2.51	110.20	7.54	0.24	0.17
E3	0.85	1.08	4.09	110.92	7.58	0.32	0.16
E4	0.52	1.38	2.92	114.70	7.83	0.31	0.16
E5	0.46	2.24	3.23	119.45	7.70	0.31	0.17
Water Quality Standard	35	5.0	3.5	150	20	0.50	0.30

1 Stations D2, D3A, E2 and E3 are located at the boundary of the ZOM and are subject to RPA. The remaining stations are control stations.
2 Source: Monthly and Quarterly DMRs submitted by the Permittee from January 2015 through December 2019.
3 Reported geometric mean is the maximum annual geometric mean from the top, middle, and bottom sampling points at each station.

3. Proposed Receiving Water Limitations

a. Basic Water Quality Criteria Applicable to the Facility

(1) The draft permit incorporates receiving water monitoring for future RPA and receiving water assessment. The discharge shall not cause a violation of any applicable water quality standard for receiving waters adopted by the DOH, as required by the Water Quality Act of 1987 (P.L. 100-4) and regulations adopted thereunder. The DOH adopted water quality standards specific for open coastal waters in HAR Chapter 11-54. The draft permit incorporates receiving water limitations and requirements to ensure the facility does not exceed applicable water quality standards.

(2) Mamala Bay is designated as “Class A Wet Open Coastal Waters.” As such, the discharge from the facility shall not interfere with the attainment or maintenance of that water quality which assures protection of public water supplies and the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife and allows recreational activities in and on the water. The draft permit incorporates receiving water limitations for the protection of the beneficial uses of Mamala Bay.

The Permittee is required to comply with the HAR Chapter 11-54, Basic Water Quality Criteria of which has been incorporated as part of the draft permit under Section 1 of the DOH Standard NPDES Permit Conditions (version 15).

(3) The following criteria are included in HAR Section 11-54-8 for recreational areas in marine recreational waters:

(a) Enterococcus content shall not exceed a geometric mean of 35 colony forming units per one hundred milliliters over any thirty day interval.

(b) A Statistical Threshold Value (STV) of 130 per one hundred milliliters shall be used for enterococcus. The STV shall not be exceeded by more than ten percent of samples taken within the same thirty-day interval in which the geometric mean is calculated.

(c) State waters in which enterococcus content does not exceed the standard shall not be lowered in quality.

(d) Raw or inadequately treated sewage, sewage for which the degree of treatment is unknown, or other pollutants of public health significance, as determined by DOH, shall not be present in natural public swimming, bathing, or wading areas. Warning signs shall be posted at locations where human sewage has been identified as temporarily contributing to the enterococcus count.

The draft permit establishes these criteria for recreational areas, as described in Part C of the draft permit, to be consistent with HAR Section 11-54-8.

c. Zone of Initial Dilution (ZID) and Zone of Mixing (ZOM)

Federal regulations at 40 CFR 125.62(a) require that at the time a 301(h) modification becomes effective, the Permittee's outfall and diffuser must be located and designed to provide adequate initial dilution, dispersion, and transport of wastewater such that the discharge does not exceed, at and beyond the ZID, all applicable State water quality standards and, for pollutants for which there are no EPA-approved standards. EPA's Amended Section 301(h) Technical Support Document (1994) describes the ZID as the area around the diffuser circumscribed by the distance "d" from any point of the diffuser, where "d" is equal to the water depth. The ZID dimensions for the Facility as defined in EPA's TDD are 469.5 feet wide and 3,860.2 feet along the centerline of the diffuser.

HAR Chapter 11-54 allows for a ZOM, which is a limited area around outfalls to allow for initial dilution of waste discharges, if the ZOM is in compliance with requirements in HAR Section 11-54-9(c). For this permit renewal, the Permittee requested that the existing ZOM for the assimilation of treated wastewater from the Mamala Bay be retained. Consistent with the current permit, the ZOM requested is 1,400 feet wide and 4,800 feet along the centerline of the diffuser, and extends vertically downward to the ocean floor. The center of the ZOM is located at Latitude 21°16'58"N and Longitude 157°54'21"W, with the major axis located on the azimuth of 80° 01' 40" from the south. Figure 2 in the draft permit shows the ZOM and ZID.

(1) Prior to the renewal of a ZOM, the environmental impacts, protected uses of the receiving water, existing natural conditions, character of the effluent, and adequacy of the design of the outfall must be considered. The following findings were considered:

(a) The Permittee's ZOM application indicates that annual analysis of the effects on the receiving waters, benthic sediment grain size distribution and a Mamala Bay Study indicate that no major physical effects are expected due to the continuation of the ZOM.

Data from 2000 through 2019 summarized in the Permittee's 2019 Fish Monitoring Report shows fish abundance and distribution fluctuate in the outfall vicinity through different years, but does not show any long term trends between fish catches and the discharge from the outfall.

An additional study conducted in 1998 using a remotely controlled video camera system to document fish near the diffuser from 1991 through 1997 indicate that the number of fish species identified has not been negatively impacted.

Historical reports (1995, 1996, and 2005) on necropsy of liver histopathology findings for fish sampled from a control station in Maunalua Bay and the Sand Island Outfall conducted by the Department of Land and Natural Resources indicate no gross or microscopic pathologic changes observed which would indicate the sewage discharged at the Sand Island Municipal Outfall had an impact on the health of the fish studied in the survey. Results of the annual necropsy comparisons and liver histopathology for fish sampled adjacent to the Sand Island ocean outfall and reference stations from 2015 through 2019 indicate no impact from the sewage discharge on the health of the fish surveyed.

Based on the limited data and studies, there is no current evidence that the outfall or the existing ZOM is adversely impacting fish health or community structure.

(b) The diffuser for Outfall Serial No. 001 reportedly provides a minimum of 221:1 dilution and discharges approximately 9,000 feet offshore. No information provided in the ZOM application indicates that dilution would be negatively impacted by current conditions.

(c) Effluent data and receiving water data are provided in Tables F-8, F-11, F-12, F-13, and F-14 of this Fact Sheet. As discussed above, biological monitoring of the Facility's diffuser found that no evidence of negative impacts to fish populations due to the diffuser was identified.

(2) HAR Section 11-54-9(c)(5) prohibits the establishment of a ZOM unless the application and supporting information clearly show: that the continuation of the ZOM is in the public interest; the discharge does not substantially endanger human health or safety; compliance with the WQS would produce serious hardships without equal or greater benefits to the public; and the discharge does not violate the basic standards applicable to all waters, will not unreasonably interfere with actual or probable use of water areas for which it is classified, and has received the best degree of treatment or control. The following findings were made in consideration of HAR Section 11-54-9(c)(5):

(a) The Facility treats domestic wastewater from the southern to southeastern portion of the Island of Oahu, serving ~460,000 people and is a necessity for public health. There are no other treatment facilities currently servicing this area and a cessation of function or operation would cause severe hardship to the residents.

(b) No known information indicates that the discharge is causing or contributing to conditions that substantially endanger human health or safety. The Permittee reports there have been no reported cases of illness which health officials attributed to the treated effluent and that enterococcus bacteria data does not indicate a shoreward movement of the effluent discharged 9,000 feet offshore.

(c) The feasibility and costs to install treatment necessary to meet applicable WQS end-of-pipe, or additional supporting information, were not provided by the Permittee to demonstrate potential hardships. However, based on effluent data, significant Facility enhancements and capital costs would likely be necessary to comply with applicable WQS for which the ZOM was applied. As discussed in Part E.3.c.(2)(a), the operation of the Facility has been found to benefit the public. No information is known that would revise the finding during the previous permit term that compliance with the applicable WQS without a ZOM would produce serious hardships without equal or greater benefits to the public.

(d) The Permit requires compliance with the effluent limitations and conditions which are protective of the actual and probable uses of the receiving water and implement applicable technology-based effluent limitations.

The Department has determined that the ZOM satisfies the requirements in HAR Section 11-54-09(c)(5).

Based on the finding that the ZOM satisfies the applicable requirements, pollutants for which a ZOM has been previously approved will retain the ZOM. These pollutants include total nitrogen, ammonia nitrogen, total phosphorus, chlorophyll a, pH, temperature, and salinity.

For receiving water limitations previously not granted a ZOM, the applicable water quality standards must be met at that ZID. These pollutants include light extinction coefficient, turbidity, and dissolved oxygen. In EPA's TDD, EPA concluded that the discharge would consistently attain the Hawaii water quality standard for dissolved oxygen, turbidity, and light extinction coefficient. As such, the cost of establishing individual receiving water monitoring locations for these parameters along the ZID is not warranted. Consistent with the approach in the previous permit, monitoring for dissolved oxygen, turbidity, and light extinction coefficient shall be conducted at the ZOM stations.

The establishment of the ZID and ZOM is subject to the conditions specified in Part E of the draft permit. The draft permit incorporates receiving water monitoring requirements which the DOH has determined are necessary to evaluate compliance of the Outfall Serial No. 001 discharges with the applicable water quality criteria, as described further in Section F.4 of this Fact Sheet.

F. Rationale for Monitoring and Reporting Requirements

40 CFR 122.41(j) specify monitoring requirements applicable to all NPDES permits. HAR Section 11-55-28 establishes monitoring requirements applicable to NPDES permits within the State of Hawaii. 40 CFR 122.48 and HAR Section 11-55-28 require that all NPDES permits specify requirements for recording and reporting monitoring results. The principal purposes of a monitoring program are to:

- Document compliance with waste discharge requirements and prohibitions established by the DOH;
- Facilitate self-policing by the Permittee in the prevention and abatement of pollution arising from waste discharge;
- Develop or assist in the development of limitations, discharge prohibitions, national standards of performance, pretreatment and toxicity standards, and other standards; and,
- Prepare water and wastewater quality inventories.

The draft permit establishes monitoring and reporting requirements to implement federal and State requirements. The following provides the rationale for the monitoring and reporting requirements contained in the draft permit.

1. Influent Monitoring

Influent monitoring is required to determine the effectiveness of pretreatment and non-industrial source control programs, to assess the performance of treatment facilities, and to evaluate compliance with effluent limitations. The proposed influent water monitoring requirements are specified in Part A.1 of the draft permit.

2. Effluent Monitoring Location, Outfall Serial No. 001

The following effluent monitoring requirements are applicable Effluent Monitoring Location, Outfall Serial No. 001.

a. Monitoring requirements for ammonia nitrogen, total nitrogen, total phosphorus, nitrate + nitrite nitrogen and turbidity have been removed from the draft Permit as the Reasonable Potential Analysis (RPA) indicates that these parameters do not have reasonable potential to cause or contribute to an excursion above State WQS. The annual geometric means for these parameters from 2015 through 2019 were below applicable WQS values.

b. Monitoring requirements for flow have been retained from the 2018 Permit to calculate pollutant loading and to determine compliance with mass-based effluent limitations.

c. Monitoring requirements for temperature have been retained from the 2018 Permit to determine compliance with water quality standards.

d. Monitoring requirements for pH, BOD_5, dieldrin, enterococcus, and TSS have been retained from the 2018 Permit in order to determine compliance with effluent limitations and to collect data for future RPAs.

e. Monitoring requirements for total oil and grease; total petroleum hydrocarbons; and fats, oils, and grease have been retained from the 2018 Permit to ensure that the facility is meeting the basic water quality criteria contained in HAR Section 11-54-4(a), which states all waters shall be free of "Floating debris, oil, grease, scum, or other floating materials," and in the DOH's Standard NPDES Permit Conditions (Version 15), which is included as an attachment to the draft permit.

f. Monitoring requirements for all other pollutants listed in Appendix 1 are retained from the 2018 Permit in order to collect data for future RPAs.

3. Whole Effluent Toxicity Monitoring

Consistent with the 2018 Permit, monthly whole effluent toxicity testing is required in order to determine compliance with whole-effluent toxicity effluent limitations as specified in Parts A.1 and B of the draft permit. Three species have been included for chronic toxicity monitoring, and the Permittee shall conduct chronic toxicity testing by rotating the test species month by month such that each test species is tested once every quarter.

4. Receiving Water Quality Monitoring Requirements

a. Shoreline Water Quality Monitoring

Shoreline water quality monitoring for enterococci is used to assess compliance with water quality criteria specific for marine recreational waters within 300 meters (1,000 feet) of shoreline, as described in Part C.1 of the draft permit. The Permittee shall monitor at five stations with a frequency of seven (7) days per month in order to calculate a geometric mean. These monitoring requirements are retained from the 2018 Permit and included in Part E.1 of the draft permit.

b. Nearshore Water Quality Monitoring

Nearshore water quality monitoring is required to assess compliance with State water quality standards, as described in Part C.2 of the draft permit. The draft permit requires the Permittee to monitor recreational waters at three (3) stations, R1 through R3. Although these stations are called recreational waters, they are beyond 300 meters (1,000 feet) from shore and, therefore, monitoring at these stations is not intended for compliance with specific water quality criteria for recreational areas in Part C of the draft permit.

In addition to station R1 through R3, the draft permit requires the Permittee to also monitor nearshore waters at five stations: C1A, C2A, C3A, C4 and C5A.

The requirement for monitoring the receiving water at the Nearshore Stations for nutrients (total nitrogen, ammonia nitrogen, total phosphorus, turbidity, chlorophyll a), Continuous Depth Profile (CDP) (dissolved oxygen, pH, temperature, salinity), Light Extinction Coefficient (LEC), and Transparency was removed as the relevant location for compliance assessment with the water quality standards is the Zone of Mixing (ZOM). The draft permit's "Section E.3. Offshore Water Quality Monitoring" provides for increased monitoring for nutrients (from once per quarter to once per month) and quarterly CDP monitoring at the ZOM stations (D2, D3A, E2, and E3) and at the control stations (E1, E5, D1, and D5). Monitoring frequency for enterococci and visual observations has also been reduced from seven (7) times per month to five (5) times permit month. The offshore water quality monitoring for visual observations and enterococci with a once per month monitoring frequency will be used to assess compliance.

Further, receiving water monitoring is necessary to evaluate the impact of the discharge on the receiving water, consistent with Section 403(c) of the CWA.

c. Offshore Water Quality Monitoring

Offshore water quality monitoring is required to assess compliance with State water quality standards, as described in Part C.2 of the draft permit. The draft permit requires the Permittee to monitor offshore waters at stations along the 50 meter (165 foot) contour and stations along the 100 meter (328 foot) contour.

The requirement for monitoring stations D4 and E4 has been removed as data from these two stations are not used in determining West Mamala Bay's or SIWWTP's compliance with water quality standards.
Further, receiving water monitoring is necessary to evaluate the impact of the discharge on the receiving water, consistent with Section 403(c) of the CWA.

d. Nearshore and Offshore Sediment Monitoring

Nearshore and offshore sediment monitoring is required to detect spatial and temporal trends in sediment pollutants and benthic organisms. The draft permit requires the Permittee to monitor nearshore and offshore sediments for chemistry and benthic organisms at the following stations:

Location	Station Name	Number of Samples at Each Station (Including Replicates)	
		Chemistry	Benthic Organisms
Nearshore	C1A	2	3
	C2A	2	3
	C3A	2	3
	C5A	2	3
Offshore	D1	2	3
	D2	2	3
	D3A	2	3
	D5	2	3
	E1	1	3
	E2	1	3
	E3	1	3
	E5	1	3

All nearshore and offshore sediment monitoring requirements have been retained from the 2018 Permit.

Further, receiving water monitoring is necessary to evaluate the impact of the discharge on the receiving water, consistent with Section 403(c) of the CWA.

e. Fish Monitoring

Fish monitoring is required at three locations, at the outfall and at two (2) fish monitoring stations (FR3 and FR4), to determine if fish are being negatively affected by effluent discharged at Outfall Serial No. 001 compared to the control stations. All other fish tissue monitoring requirements have been retained from the 2018 Permit.

Further, receiving water monitoring is necessary to evaluate the impact of the discharge on the receiving water, consistent with Section 403(c) of the CWA.

G. Rationale for Provisions

1. Standard Provisions

The Permittee is required to comply with DOH Standard NPDES Permit Conditions, which are included as part of the draft permit.

2. Monitoring and Reporting Requirements

The Permittee shall comply with all monitoring and reporting requirements included in the draft permit and in the DOH Standard NPDES Permit Conditions.

3. Special Provisions

a. Reopener Provisions

The draft permit may be modified in accordance with the requirements set forth at 40 CFR 122 and 124, to include appropriate conditions or limitations based on newly available information, or to implement any new state water quality criteria that are approved by the EPA.

b. Special Studies and Additional Monitoring Requirements

(1) Toxicity Reduction Requirement. The draft permit requires the Permittee to submit an initial investigation Toxicity Reduction Evaluation (TRE) workplan to the Director and EPA which shall describe steps which the Permittee intends to follow in the event that toxicity is detected. This requirement is retained from the 2018 Permit and is discussed in detail in Part B.5 of the draft permit.

4. Special Provisions for Municipal Facilities

a. Pretreatment Requirements

The federal CWA Section 307(b), and federal regulations, 40 CFR 403, require POTWs to develop an acceptable industrial pretreatment program. A pretreatment program is required to prevent the introduction of pollutants which will interfere with treatment plant operations or sludge disposal, and prevent pass through of pollutants that exceed water quality objectives, standards or permit limitations. Pretreatment requirements are imposed pursuant to CWA Sections 307(b), (c), (d), and 402(b), 40 CFR 125, 40 CFR 403, and in HAR Section 11-55-24.

The Permittee's pretreatment program was submitted to EPA in 1979 and received approval on July 29, 1982. The Permittee submitted a revised program on June 9, 1994 but no formal approval was issued. On October 16, 1998, the Permittee further streamlined its program. There are currently six non-categorical significant industrial users.

The draft permit includes a pretreatment program in accordance with federal regulations and State pretreatment regulations. The pretreatment requirements are based on the 2018 Permit and are consistent with NPDES permits issued to other Hawaii POTWs. The draft permit also continues to require the Permittee to implement and update its BMP-based program for controlling animal and vegetable oil and grease.

Large applicants for a draft NPDES permit under section 301(h) of the CWA with a service population greater than 50,000 that receives one or more toxic pollutants from an industrial source are required to comply with urban area pretreatment requirements at 40 CFR 125.65. The draft permit requires the Permittee to comply with urban area pretreatment requirements since the facility continues to operate as a primary treatment plant.

b. Biosolids Requirements

The use and disposal of biosolids is regulated under federal laws and regulations, including permitting requirements and technical standards included in 40 CFR 503, 257, and 258. The biosolids requirements in the draft permit are in accordance with 40 CFR 257, 258, and 503, are based on the 2018 Permit and are consistent with NPDES permits issued to other Hawaii POTWs.

5. Other Special Provisions

a. **Water Pollution Control Plan.** The draft permit requires the Permittee to submit a wastewater pollution control plan by March 31 each year. This provision is retained from the 2018 Permit and is required to allow DOH to ensure that the Permittee is operating correctly and attaining maximum treatment of pollutants discharged by considering all aspects of the wastewater treatment system. This provision in included in Part F of the draft permit.

b. Wastewater treatment facilities subject to the draft permit shall be supervised and operated by persons possessing certificates of appropriate grade, as determined by the DOH. If such personnel are not available to staff the wastewater treatment facilities, a program to promote such certification shall be developed and enacted by the Permittee. This provision is included in the draft permit to assure that the facility is being operated correctly by personnel trained in proper operation and maintenance. This provision is retained from the 2018 Permit and included in Part J.1 of the draft permit.

c. The Permittee shall maintain in good working order a sufficient alternate power source for operating the wastewater treatment and disposal facilities. This provision is retained from the 2018 Permit in order to ensure that if a power failure occurs, the facility is well equipped to maintain treatment operations until power resumes. If an alternate power source is not in existence, the draft permit requires the Permittee to halt, reduce, or otherwise control all discharges upon the reduction, loss, or failure of the primary source of power. This provision is included in Part J.2 of the draft permit.

H. Public Participation

A public notice of the draft permit was published in the ***Honolulu Star-Advertiser*** on February 8, 2021 soliciting public comment on the proposed action for a 30-day period. The permit application, applicable documents, draft permit and fact sheet were available for public review at the CWB office and on the CWB website. Persons wishing to comment upon or object to the draft NPDES permit in accordance with HAR Section 11-55-09(b), had the opportunity to submit their comments through email at: cleanwaterbranch@doh.hawaii.gov, or in writing either in person or by mail to:

State of Hawaii
Clean Water Branch
2827 Waimano Home Road, Room #225
Pearl City, Hawaii 96782

Response to comments on the public notice NPDES permit and tentative determinations for the Sand Island Wastewater Treatment Plant are summarized in Appendix 2.

Appendix 1 Brown and Caldwell Sand Island Dilution Study dated June 30, 2017

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Technical Memorandum

Prepared for: City and County of Honolulu

Technical Memorandum

Subject:	Sand Island Wastewater Treatment Plant Ocean Outfall Dilution Analysis
Date:	June 29, 2017
To:	Ross Tanimoto, P.E., Deputy Director City and County of Honolulu, Department of Environmental Services
From:	Peter Ono, P.E.
Copy to:	Clifton Bell, Brown and Caldwell Philip Roberts, Ph.D.

Prepared by: William K. Faisst
William K. Faisst, Ph.D., Vice President

Prepared by: Philip J.W. Roberts
Philip J.W. Roberts, Ph.D.

Reviewed by: Peter R. Ono
Peter Ono, P.E.

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Peter Ono, P.E.

Limitations:

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List of Abbreviations

σ_t	one thousandth of a g/cm³, or 1 kg/m³
µg/L	microgram(s) per liter
%	percent
ADCP	acoustic Doppler current profiler
°C	degree(s) Celsius
CCH	City and County of Honolulu
cm	centimeter(s)
CTD	conductivity, temperature, and depth
DOH	State of Hawaii, Department of Health
erf	standard error function
ft	feet
g/cm³	gram(s) per cubic centimeter
km	kilometer(s)
m	meter(s)
MLLW	mean lower low water
NPDES	National Pollutant Discharge Elimination System
ppt	part(s) per thousand
psu	practical salinity unit
s	second(s)
TM	Technical Memorandum
WWTP	Wastewater Treatment Plant
ZID	zone of initial dilution
ZOM	zone of mixing

Section 1: Executive Summary

This technical memorandum (TM) presents results from dilution analyses for the discharge from the City and County of Honolulu (CCH) Sand Island Wastewater Treatment Plant (SIWWTP) (National Pollutant Discharge Elimination System-NPDES-Permit No. HI 0020117), carried out by Brown and Caldwell with assistance from Dr. Philip Roberts. Table ES-1 presents statistically-derived dilution estimates. The work presented in this TM examined predicted dilution for all discharges and separately for dilution achieved only for discharges that rose into the top 40 meters (131 feet) of the water column. Predicted dilutions for the latter case are significantly higher since more mixing in receiving waters occurs during the longer buoyant rise time.

Table ES-1. Predicted Dilutions

Description	Notes	Dilution	
		Whole water column	Upper 40 m of water column
Minimum dilution at ZID	Ten percentile value of dilution at peak flow	221	624
Average dilution at ZID	Geometric mean dilution at design flow	550	943
Minimum dilution at ZOM including far field diffusion but no bacterial decay	Ten percentile value of dilution at peak flow	225	634
Average dilution at ZOM including far field diffusion but no bacterial decay	Geometric mean dilution at design flow	560	961
Minimum dilution at ZOM including far field diffusion and bacterial decay	Ten percentile value of dilution at peak flow	247	711
Average dilution at ZOM including far field diffusion and bacterial decay	Geometric mean dilution at design flow	616	1084

Section 2: Introduction

At the direction of the CCH Department of Environmental Services, Brown and Caldwell, with technical support from Dr. Philip Roberts, prepared this dilution study TM for the SIWWTP (NPDES Permit No. HI 0020117) and effluent outfall.

Section 3: Dilution Modeling Approach and Assumptions

This section describes and discusses dilution calculations as required for the SIWWTP NPDES permit and ocean outfall. This TM presents modeling carried out using the most appropriate available data. We present dilution analyses for the zone of initial dilution (ZID), defined as where the near-field mixing is completed and the Zone of Mixing (ZOM) defined in the permit as extending 700 ft (213 m) from the diffuser. We completed numerical simulations using field-measured density stratification for five years, 2012 – 2016.

Figure 3-1 illustrates the basic processes under consideration schematically. For the Sand Island discharge, a multiport diffuser ejects wastewater effluent horizontally as round turbulent jets. Because the density of domestic sewage is close to that of fresh water, it is very buoyant in seawater. The jets therefore begin rising toward the surface and may merge with adjacent jets as they rise. The turbulence and entrainment induced by the jets causes rapid mixing and dilution. The region in which this mixing occurs is called the "near field" or "initial mixing region." If strong enough, oceanic density stratification may trap the rising plumes below the water surface; at that point the effluent field stops rising and begins to spread laterally. The effluent field then drifts with the ocean current; oceanic turbulence diffuses it and dilutes it further in a region called the "far field." The mixing rate, or increase of dilution, occurs much more slowly in the far field than in the near field. In addition, Enterococcus contained in the effluent die off due primarily to exposure to sunlight as the plume drifts in the far field.

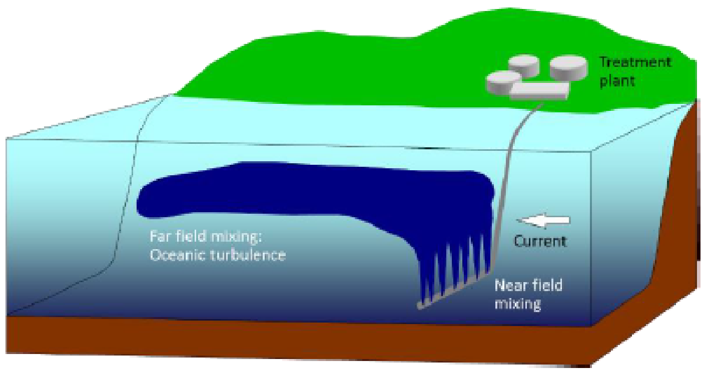


Figure 3-1. Typical behavior of wastewater discharged from an outfall into coastal waters

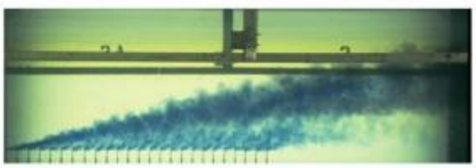
From Roberts, et al. (2010).

Near field mixing caused by the discharge buoyancy and momentum occurs over distances of 10 to 1,000 m and times of a few minutes. Far field mixing, transport by ocean currents and diffusion by oceanic turbulence, occurs over distances of 10 m to 10 km and time scales of 1 to 20 hours.

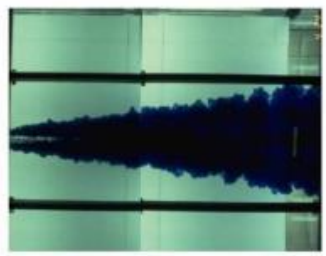
3.1 Near Field Model

For this study we used NRFIELD, which is a part of the latest version of Visual Plumes. NRFIELD was specifically developed for effluent discharges into marine environments from multiport diffusers. It originally was based on the extensive experiments on multiport discharges into flowing density-stratified environments by Roberts, Snyder, and Baumgartner (1989abc), hence its original name of RSB. It has since been continually updated as reported in Tian et al. (2003, 2004) and others. Following the updates, and because it emphasizes the flow properties at the end of the near field, it was renamed NRFIELD. Since it was designed specifically for conditions typical of very buoyant discharges of domestic effluent from multiport diffusers into stratified oceanic waters, we selected NRFIELD as the most appropriate model for modeling discharges through the Sand Island Ocean Outfall. Data from field testing have verified NRFIELD performance, for example Hunt et al. (2010). In field tests of the Hilo, Hawaii, outfall (Brown and Caldwell, 2005), NRFIELD gave dilution predictions that agreed well with field measurements. It accounts for discharges from both sides of the diffuser and varying current directions relative to the diffuser ranging from perpendicular to parallel. NRFIELD incorporates receiving water density stratifications and it includes the lateral spreading after the terminal rise height and subsequent turbulent collapse that occurs at the near field end.

Laboratory photographs presented in Figure 3-2 illustrate the essential physical processes modeled for a buoyant discharge from a multiport diffuser into a flowing current parallel to the diffuser. We show the parallel current case because a parallel current is present at the Sand Island diffuser. Buoyant effluents rise in the water column and are either trapped by the ambient density stratification if it is strong enough, or reach the water surface if it is weak. The plumes from individual ports are swept downstream and merge as they rise; when they reach the terminal rise height they spread laterally in a V-shape. As the current speed increases the rise height and the spreading angle decrease, dilution increases, and the distance to the end of the near field increases. NRFIELD incorporates these effects. The plume may overshoot before settling down to its final equilibrium level, sometimes referred to as the "second trap level." The State of Hawaii, Department of Health (DOH) guidelines specify that the second trap level be used in the ZID dilution calculations; NRFIELD automatically predicts dilutions at this level, which corresponds to the end of the near-field processes.



a) Side view



b) Overhead view

Figure 3-2. Trapped buoyant plume from a multiport diffuser into a flowing stratified current parallel to the diffuser

From Roberts, et al. (1989).

The primary outputs from NRFIELD are the minimum dilution, the plume rise height, and wastefield thickness at the end of the near field as illustrated in Figure 3-3. The near field is defined as the region where mixing is caused by turbulence and other processes generated by the discharge itself, i.e., the buoyancy and momentum of the discharge (Roberts et al. 2010). For further discussion, see Doneker and Jirka (1999), and Roberts (1999). Thus, the near-field definition is consistent with the definition of the ZID in the DOH Dilution Model Guidance that states: "Dilution at the ZID is the level of mixing when jet and buoyant mixing (near field processes) are complete." Following completion of the near field processes, the plume drifts with the ocean current and is diffused by oceanic turbulence in the far field.

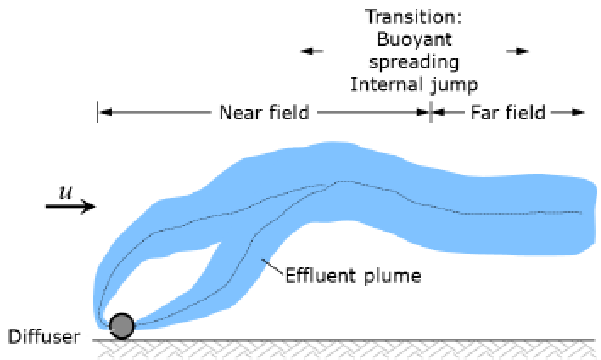


Figure 3-3. Trapped buoyant plume from multiport diffuser in stationary and flowing stratified environments

From Roberts et al. (1989).

3.2 Far Field Diffusion and Bacterial Decay

For this TM we have taken the distance of the ZOM from the diffuser as 700 feet (213 m) per the permit.

The far-field diffusion from the ZID to the ZOM is predicted by Brooks' (1959) solution to the diffusion equation assuming the 4/3 power law of diffusion:

$$\varepsilon = \alpha L^{4/3}$$

where ε is the diffusion coefficient, α is a constant, and L is the diffuser length. The far field dilution S_f, is given by (Roberts, 1999a):

$$S_f = \left[erf\left(\frac{3/2}{\left(1+8\alpha L^{-2/3} t\right)^3 - 1} \right)^{1/2} \right]^{-1}$$

where t is the travel time from the diffuser to the ZOM and *erf* is the standard error function.

Fischer, et al. (1979) quote values of α in the range of 0.002 to 0.01 cm$^{2/3}$/s. The higher values are appropriate for the early stages of diffusion beyond the near field so for the analyses presented in this TM, the value of α is taken to be 0.01 cm$^{2/3}$/s.

Bacterial decay is modeled as a first-order decay process:

$$\frac{c}{c_o} = 10^{-\frac{t}{T_{90}}}$$

where c_o is the bacterial concentration after completion of near field mixing, c the bacterial concentration after travel time t and T_{90} is a decay rate expressed as the time for 90% reduction in bacteria due to mortality.

The decay rate depends on solar intensity and so is lower for a submerged field than for one at the surface. Landry, et al. (1996) made measurements to simulate the decay of E. coli and Enterococcus at various levels of light intensity in Hawaiian waters. The decay rates of E. coli and Enterococcus were similar and are discussed in Roberts (1999a). For near-surface light conditions, the average decay rate was T_{90} = 9.7 hours. The lowest light level tested was 3 percent of surface light, for which the average decay rate was T_{90} = 24.1 hours. Hence, in the following analyses we assume T_{90} = 9.7 hours for a surfacing effluent field and T_{90} = 24.1 hours for a submerged effluent field.

The combined dilution due to far field mixing and bacterial decay is the product of the far-field dilution S_f and the effective dilution due to decay, which is equal to c_o/c. The above equations show that both factors depend solely on the travel time from the ZID to the ZOM. They will be higher for slow current speeds and lower for high current speeds. The ZOM dilution results were weighted per the frequency of current speeds and the dilution and plume submergence within each current speed range.

3.3 Outfall Description

Figure 3-4 shows the Sand Island ocean outfall and the local bathymetry. The outfall diffuser is in a water depth of 225 to 235 ft below mean sea level and is located about 9,120 feet (2,780 m) from the shoreline. The diffuser consists of three sections with diameters of 84 inches, 66 inches, and 48 inches (2.13, 1.68, and 1.22 m, respectively). The computed diffuser length is 3,384 ft (1031.4 m). It has 284 ports in total of varying diameters consisting of: 46 - 3.00 inch ports, 90 – 3.18 inch, 74 - 3.34 inch, 72 - 3.53 inch and two offshore end ports 7-inches in diameter. The ports along the diffuser are in port pairs spaced 24 feet (7.32 m) apart. Due to the varying port sizes, the diffuser was set up in NRFIELD as follows: 284 total ports in opposing pairs at 24 feet (7.32 m) spacing with an equivalent port diameter of 3.33-inches (0.085 m) to maintain total port area and therefore, the jet momentum flux, at an average depth of 230 ft (70.1 m). Based on the record drawings the orientation of the diffuser axis is taken as 89° clockwise from north.

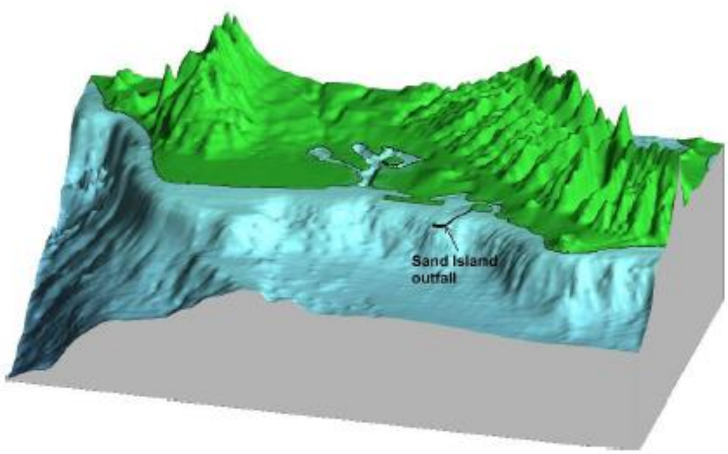


Figure 3-4. Sand Island Ocean Outfall and local bathymetry.

3.4 Oceanographic Data

A CCH consultant measured currents with an Acoustic Doppler Current Profiler (ADCP) located near the diffuser on the 230-ft depth contour. Measurements were taken from January 22, 2007 through April 19, 2009 with data recorded at 20-minute intervals in 21 bins spaced 3.0 m apart vertically.

Figure 3-5 shows a representative polar scatter diagram of the currents from the bin at a depth of 35 m, near to mid-depth, for January 22, 2007 through May 7, 2007, superimposed on a map of the outfall and diffuser. For this period, reported speeds range from zero to 75 centimeters per second (cm/s). The average speed is 14 cm/s. The predominant currents flowed along an axis oriented at 90° clockwise from North, almost parallel to the orientation of the diffuser axis (the first principal component axis, shown in blue). The currents have a significant semi-diurnal component and reverse with the tide. As summarized in Table 3-1, we extracted the frequency distribution of speeds from the data in 10 groupings or bins, with percent occurrence as shown.

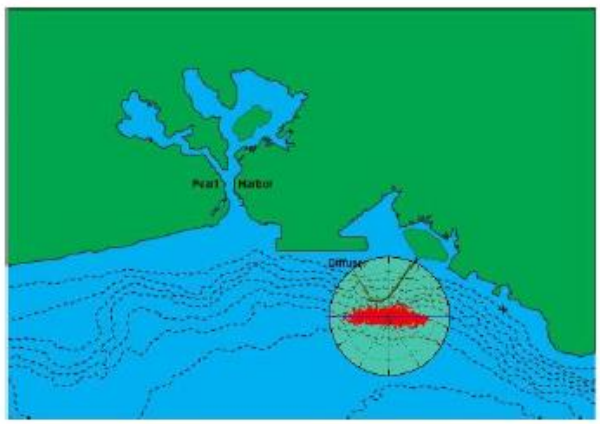


Figure 3-5. Polar scatter diagram of ADCP currents at mid-depth. The outer circumference is 80 cm/s and the blue line is the first principal component axis.

Table 3-1. Frequency distribution of current speeds at mid-depth used for dilution modeling

Simulated speed (cm/s)	Speed range (cm/s)	Frequency of occurrence (%)
2.5	0-4.9	18
7.5	5-9.9	25
12.5	10-14.9	20
17.5	15-19.9	14
22.5	20-24.9	10
27.5	25-29.9	6
32.5	30-34.9	3
37.5	35-39.9	2
42.5	40-44.9	1
47.5	>45	1
	Total	100

CCH has collected quarterly CTD profiles beginning in January 1995 near the diffuser at the locations shown in Figure 3-6. CCH made measurements at one meter intervals at depths down to about 100 m. The off-shore stations are labeled D1 through D5 and E1 through E5. To illustrate the variability of the density profiles, Figure 3-7 presents plots for all profiles measured at stations E1 through E5 for the past five years (2012 to 2016) down to the diffuser depth of 70.1 m (230 feet, the modeled diffuser depth).

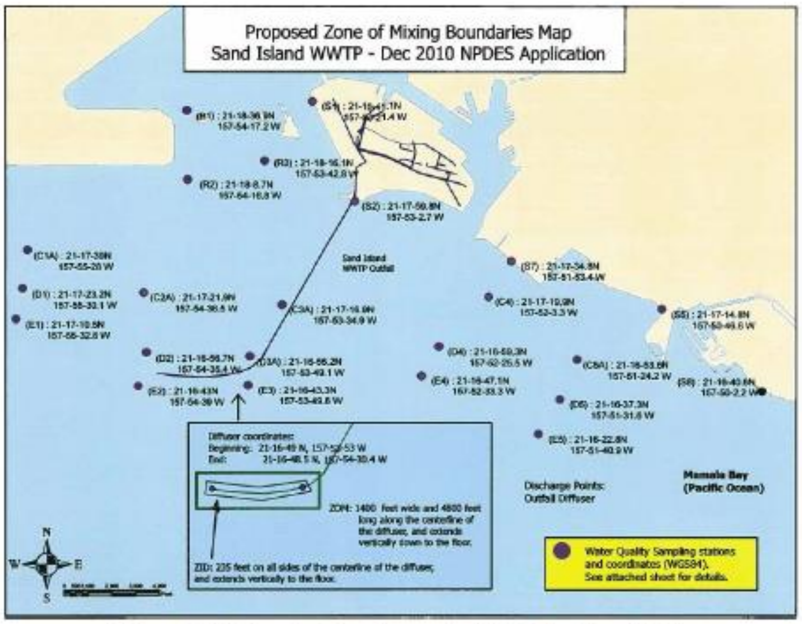


Figure 3-6. Station locations for quarterly CCH density profiling.

The quarterly profiles generally show variable stratification. Density differences over the water column down to the diffuser level range from zero (well mixed) to 2.1 σ_t (strongly stratified) (one σ_t is one thousandth of a g/cm^3, or 1 kg/m^3). The 10-percentile density difference is 0.04 σ_t and the median density difference is 0.44 σ_t.

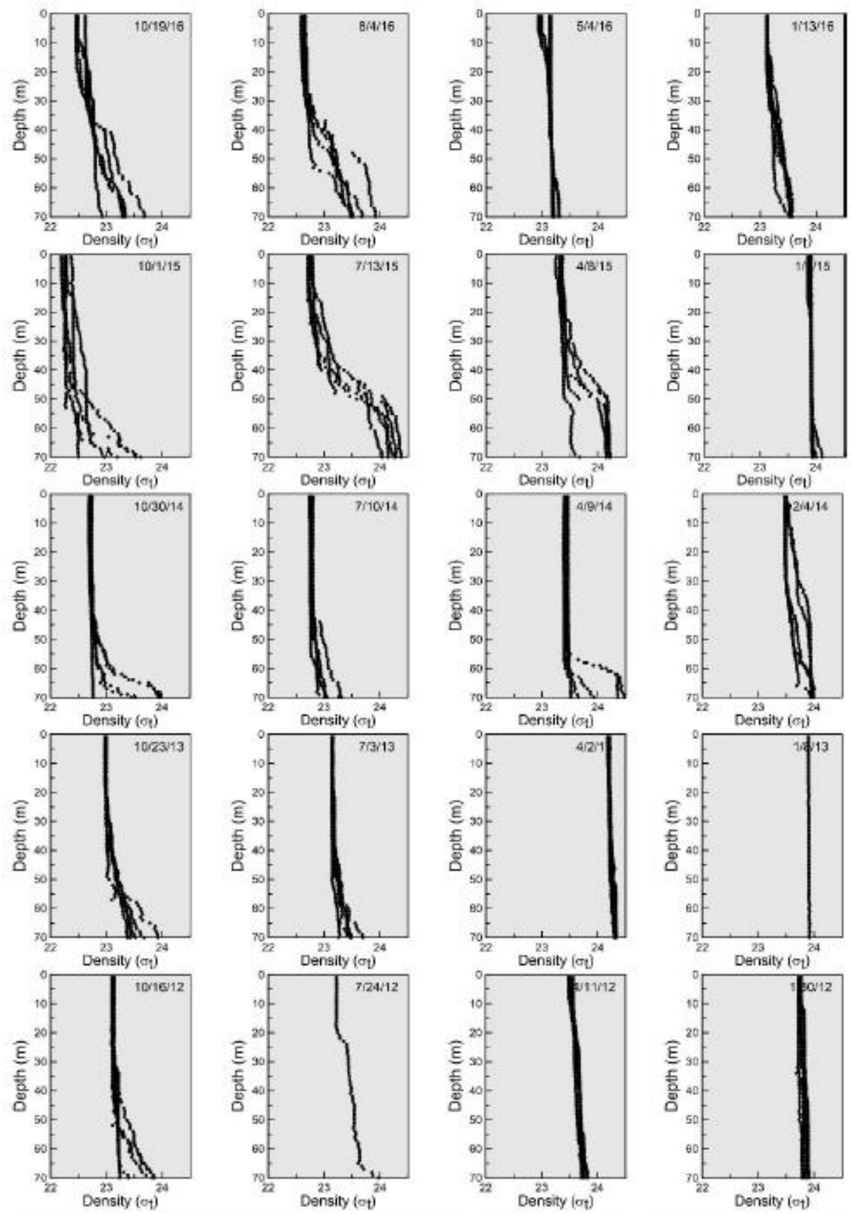
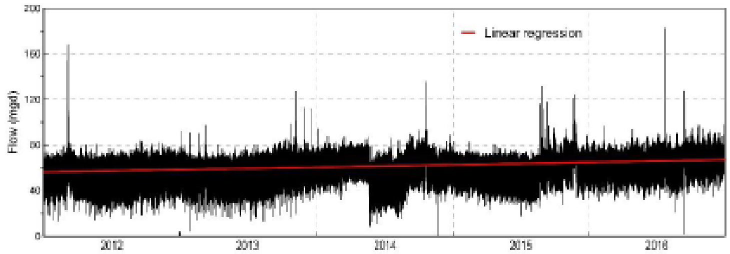


Figure 3-7. Representative quarterly density profiles measured near Sand Island ocean outfall, 2012 -2016. Stations E1 through E5.

3.5 Sand Island Wastewater Treatment Plant Flows

CCH staff measure and report effluent flows hourly at the SIWWTP. We reviewed the data and removed obvious spikes. Figure 3-8 presents the results plotted for the years 2012 through 2016 and a detail for the year 2016.

To obtain the peak 3-hour flow rate, we applied a moving average to the 2016 data and extracted the daily maxima. The peak value was assumed to be the 90% value (to avoid data spikes and wet weather events); this value was 86.2 mgd. The data from 2012 to 2016 show an average growth rate of about 2.2 mgd/year; so we extrapolated this trend to estimate future flows increasing by 11 mgd over the next five years (to 2021). Table 3-2 reports the flow rates used for this study.



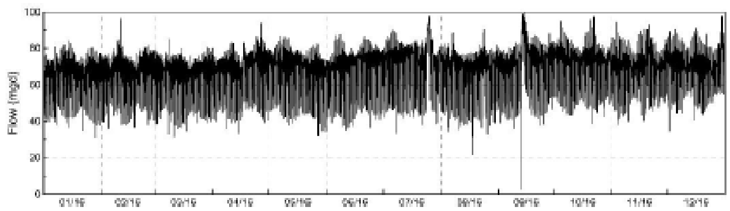


Figure 3-8. Sand Island hourly WWTP flows 2012 - 2016 and 2016 detail.

Table 3-2. Sand Island Wastewater Treatment Plant Dry Weather Flow Characteristics

Parameter	Flow, mgd (m³/s)	
	2016	Projected 2021
Average	67.1 (2.94)	78.1 (3.42)
3-hour peak	86.2 (3.78)	97.2 (4.26)
Design	90.0 (3.94)	90.0 (3.94)

Brown AND Caldwell

3.6 Effluent Density

The effluent density, in particular the density difference between the effluent and the receiving waters, affects dilution. For analyses presented in this TM we obtained effluent temperature and salinity data from CCH. CCH measured effluent temperatures daily from 1/1/2012 to 1/13/2015, and then approximately weekly until 12/31/2016. Eleven values of salinity were obtained from 2010 and 2012. Dilution decreases as the effluent density increases. For minimum dilution calculations, we assumed that the effluent salinity would be the 90th percentile value (7.1 psu) and the effluent temperature was the 10th percentile value (25.0ºC), leading to a computed effluent density of 2.4 σ_t (1.0024 g/cm^3). For average dilutions, we assumed the average salinity (5.7 psu) and average temperature (26.7°C) for a computed effluent density of 1.0 σ_t. (1.0010 g/cm^3)

Section 4: Dilution Simulations

4.1 Definitions of Dilution

We adopted the following dilution definitions for this TM:

- **Minimum Dilution at ZID (Critical dilution):** Ten percentile value of the dilutions computed at the projected 3-hour peak flow rate.
- **Average Dilution at ZID:** Geometric mean of the dilutions computed at the design flow rate.
- **Minimum Dilution at ZOM:** Ten-percentile value of the dilutions computed at the projected 3-hour peak flow rate. The calculations include far field diffusion but no bacterial decay.
- **Average Dilution at ZOM:** Geometric mean of the dilutions computed at the design flow rate. The calculations include far field diffusion but no bacterial decay.
- **Minimum Dilution at ZOM:** Ten-percentile value of the dilutions computed at the projected 3-hour peak flow rate. The calculations include far field diffusion and bacterial decay.
- **Average Dilution at ZOM:** Geometric mean of the dilutions computed at the design flow rate. The calculations include far field diffusion and bacterial decay.

4.2 Results

We ran NRFIELD using the profiles from the 10 offshore stations (Figure 3-6): D1 through D5 and E1 through E5, from 2012 to 2016. Excluding missing days, the data include 192 receiving water density profiles. Simulations were carried for the design and peak flows in Table 3-2 and the mid-current speed in each of the 10 frequency bins in Table 3-1, a total of 3,840 runs. The dilution results were weighted per the current speed distribution from Table 3-1 to account for the effect of currents on dilution and plume rise height. We report results for the whole water column and separately for plumes that rise into the upper 40 m of the water column. Table 4-1 summarizes the results.

Table 4-1. Predicted Dilutions

Description	Notes	Dilution	
		Whole water column	Upper 40 m of water column
Minimum dilution at ZID	Ten percentile value of dilution at peak flow	221	624
Average dilution at ZID	Geometric mean dilution at design flow	550	943
Minimum dilution at ZOM including far field diffusion but no bacterial decay	Ten percentile value of dilution at peak flow	225	634
Average dilution at ZOM including far field diffusion but no bacterial decay	Geometric mean dilution at design flow	560	961
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Average dilution at ZOM including far field diffusion and bacterial decay	Geometric mean dilution at design flow	616	1084

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